VOL. 80 No. 2055
NOVEMBER 29 1958

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IN THIS ISSUE

U.S. Caprolactam Plans	894
Laporte's New A.T.P. Plant	895
Letters to the Editor	897
Distillates	898
C.A. Quoted at Tribunal	899
U.K. Chemical Output in 1957	904
Swedish Plastics Conference	905
Autumn Gas Research Meeting	907
Developments in Tin Plating	909
People in the News	910
In Parliament	910
Overseas News	911
Trade Notes	912
Reagents for Zirconium	912
Commercial News	913
Market Reports	913
New Patents	914
Diary Dates	914

Annual subscription is: home, 52s 6d, overseas, 60s, single copies 1s 6d (by post 1s 9d)

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CHEMICAL AGE

BOUVERIE HOUSE · 154 FLEET STREET · LONDON · EC4

N.C.L SURPRISE MOVE

AMONG four proposals made by the National Chemical Laboratory steering committee, due for discussion on 11 December, is the suggested closure of the N.C.L. microbiology unit at Teddington. The proposal involves the shut-down of research on economic and industrial microbiology and the replacement of the unit by special university grants.

This proposal will undoubtedly come as a shock to industry, because the very valuable work of the unit in studying microbial activities is of wide economic importance. In fact, the scope of the group's work, which has dealt with microbial production of chemicals, the deterioration of materials by microbes and the study of various specialised bacteria of economic importance in nature, is just reaching fruition. Microbiology is a large but neglected field of obvious importance to the U.K. and the Commonwealth.

The small N.C.L. microbiology group has only been able to touch its fringe and indeed, its present activities have been confined to the following: basic and applied research on sulphate-reducing, sulphate-oxidising and methane-producing bacteria; maintenance of the National Collection of Industrial Bacteria; and advisory work on economic microbiology. For the National Collection of Industrial Bacteria, 1,000 pure strains have been maintained and during this year 1,600 cultures have been distributed. The collection is now being sent to the D.S.I.R. Torry Research Station, Aberdeen.

Sulphate-reducing bacteria, widespread in nature, are of particular importance in underground corrosion and in polluted or stagnant waters, and in water bottoms of gas petrol and kerosene storage tanks. But these bacteria may be useful in supplementing sulphur supplies from indigenous materials, such as sewage sludge enriched with waste sulphate.

N.C.L.'s microbiology unit has, in fact, been responsible for developing a process for the production and recovery of hydrogen sulphide during the anaerobic digestion of raw sewage sludge enriched with calcium sulphate. The hydrogen sulphide can readily be converted to sulphur or sulphuric acid by well-established processes. The process has now reached pilot plant scale at the London County Council Northern Outfall Works, Beckton. From a daily treatment of 50 lb. of sludge and 5 lb. calcium sulphate, it has been proved possible to obtain 10 oz. of elemental sulphur a day.

The trials have confirmed the laboratory results obtained by N.C.L.'s microbiology unit, and the L.C.C. are now getting out estimates for a plant to treat 400 tons of sludge a day.

At the Northern Outfall Works there is already a 1,200 tons a day digested sludge plant producing methane. Extensions to this plant were planned some time ago. Part of the plant is now under way and will be opened next year and the remainder of the extensions are expected to be completed in the course of a year or two . These extensions were planned before the sulphur investigations were found to be successful.

Today, the South Middlesex Sewage Works at Mogden does not use any outside source of power such as coal, electricity or gas, because it runs all its machinery and transport on methane produced by bacterial fermentation of sewage.

Dewatering of sewage sludge has been another problem under investigation by the microbiology unit. Settlement of sludges and hence dewatering of sludges fermented for methane is retarded by the continuous evolution of gas bubbles; in hot weather the sludge frequently rises to the surface because of the buoyancy of occluded gas bubbles. This phenomenon does not occur, however, with sludges fermented for sulphide. Sludges from the Beckton pilot plant have settled more and faster than the methane digested sludges. The amount of removable water in the sulphide sludges has been found to be approximately two-to-four times more than in the methane sludges. The obviously represents a considerable reduction in the quantity of sludge for disposal at sea and at the same time represents a considerable saving in transport costs by reducing the amount of water which is at present being carried.

This economically important work carried out by the N.C.L. microbiology unit has gained world-wide recognition. The work, too, has been undertaken latterly with a reduced staff (13 against 20) because of a reduced budget.

The proposals to replace the unit by special university research grants cannot be considered satisfactory. Such grants would support a man for a year to two years, but there would not be the same continuity of effort as has been realised at the N.C.L., where there has been a sustained effort for the last ten years.

It is understood that the National Coal Board has offered a large grant for research into microbiology of interest to the coal industry and the L.C.C., having regard to the success of the pilot plant work in producing elemental sulphur methane are now going ahead with semi-plant scale plans.

A recent D.S.I.R. research Survey was carried out on industrial and economic microbiology in North America (see CHEMICAL AGE, 12 July, p. 61). This showed that up to the period ended April 1957, in the fields of microbial deterioration and of water pollution more work is sponsored by the Government in the U.S. than in the U.K. In microbiological work generally the U.S. Government is very much alive to the economic importance of developments in the field compared with the U.K.

Therefore, we feel strongly that the reputation and solid worth of the N.C.L. unit's valuable work should not be dissipated by passing it to a number of universities, whose approach must be somewhat more academic. The D.S.I.R. Research Council should not only reject this particular proposal but should seriously consider financially strengthening the N.C.L. microbiological unit, whose work is of great actual and potential value to U.K. industry and the national economy.

U.S. CAPROLACTAM PLANS

NEWS that E. I. Du Pont de Nemours and Co. would build a 50 million lb. a year caprolactam unit at Beaumont, Texas, seems to have surprised the U.S. chemical industry, particularly as caprolactam (monomer for nylon 6) capacity there hardly exceeds 30 million lb. annually. Construction of the Du Pont plant is to begin early next year, and the plant is scheduled to be in operation in the latter half of 1960. The greater surprise, however, is Du Pont's announcement of a new process which will mean 'considerably below' current price levels (at present 57 cents per lb.). The company plan to sell caprolactam at under 50 cents per lb. when in commercial production, and this price is regarded by competitors as 'realistic'.

The new process is stated to use petroleum derivatives (cyclohexane) and to give cyclohexylamine as co-product. The monomer will be sold as Du Pont have not suggested they have plans to manufacture nylon 6 fibre. Also nylon 6 for moulding powder, they report, is a small fraction of their proposed output of caprolactam.

Market surveys carried out by Du Pont have indicated that there is a sizeable and growing market for nylon 6 fibre. A market also exists, it is reported, for nylon 6 moulding powder. Du Pont forecast that nylon 6 fibre and moulding powder production will take something like 110 million lb. of caprolactam a year within the next 10 years. This year caprolactam has been in short supply in the U.S.

What of the other U.S. manufacturers of caprolactam? Sole commercial producer of caprolactam in the U.S. is Allied Chemical Corporation, having an annual capacity of 30 million lb. In the coming year, their plant is to be expanded so that capacity is doubled. The company believe that as a result of improved technology in the cumene-phenol process plant for which is now under way, they will be able to reduce their price for caprolactam. The cumene-phenol route they consider is the most economical approach.

Another small unit to supply 'tank car quantities' now reaching the finishing stage is being put up by Commercial Solvents Corporation. Plans to follow this unit with a substantial-sized plant later are under consideration.

Earlier this year, Spencer Chemical Inc. and Industrial Rayon Corporation announced the formation of Ohio River Chemical which was to set up a $10 million caprolactam plant. Plans have, however, been postponed while new technical processes are reviewed. The caprolactam would be used largely for captive purpose.

Other companies considered as interested in caprolactam production are Foster Grant, Dow Chemicals and Reichhold Chemicals. Foster Grant have a new nylon 6 plant and, it is reported, will eventually build a caprolactam unit. Dow Chemicals are known to have been carrying out market studies, but no word has been heard as to whether they may produce caprolactam. Reichhold with their phenol resources could enter the field.

This recent interest in caprolactam suggests considerable confidence in the nylon 6 fibre and moulding powder market. The hint of lower prices, of course, will improve the position of nylon 6 fibre manufacturers and could result in their entry into the heavy yarn markets, e.g., tyre cord production.

MORE POLYETHERS FOR U.S.

ATLAS Powder Co., US, have introduced polyethers—propylene oxide—sorbitol adducts—for rigid foam application, and Union Carbide Chemicals have added to their polyether range a new triol for rigid foams. Already in the US market are Wyandotte Chemicals Corporation and Dow Chemical. Soon to enter the field are Jefferson Chemical with a line of polypropylene glycols. Their propylene oxide and glycol manufacturing plants have been delayed by strikes.

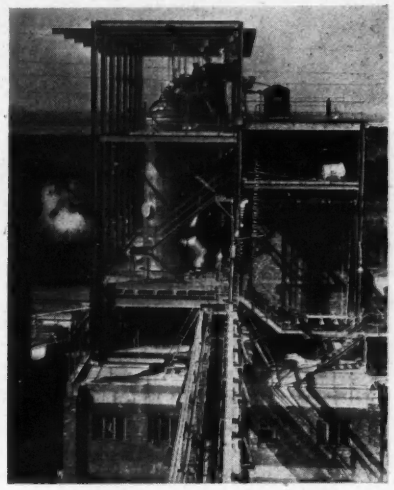
The new Atlas polyether with six functional OH groups in the molecule (molecular weight 760) is aimed at use in rigid foams. According to the company, the product can reduce manufacturing costs by as much as 25 per cent. Initial price is quoted at 35 cents per lb.; this is expected to fall as production increases.

The triol for rigid foams, new to Union Carbide's range, is reported to be based on propylene oxide. Initial price for the product is quoted at 40 cents per lb. The company's polyglycols and propylene oxide hexanetriol adducts (priced at 25 cents per lb.) are stated to have had considerable success in flexible urethanes.

Wyandotte's polypropylene glycol and products cover the entire range of urethanes including rigids, and Dow Chemical have a series of polyglycols for urethanes including polypropylene glycol. Price of both Wyandotte's and Dow's polypropylene glycol is 23 cents per lb.

Laporte's H.T.P. Plant is World's Largest

Company's Output Doubled with New and Cheaper Organic Process



Distillation plant at Warrington

BUILT at a cost of approximately £2½ million Laporte Chemicals Ltd. have this week opened the only chemical plant of its kind in this country, and the largest in the world, at Baronet Works, Warrington, to provide high test peroxide (H.T.P.) fuel for rocket motors and guided weapons. The plant will assist Laporte Chemicals to double their output of high strength hydrogen peroxide. The entirely new method of manufacture employed will make H.T.P. appreciably cheaper than existing processes, it is claimed. (See also 'Chemical Age,' 11 October, p. 591.)

Apart from selling H.T.P. to the aircraft industry as a fuel for rocket motors and guided weapons, this product will also go to the Royal Navy for use as a propellant for torpedoes and for two experimental submarines. Hydrogen peroxide will also be available for commerce as a bleaching agent and chemical intermediate.

Construction of the plant began in November 1956. The first supplies of H.T.P. were produced less than two years later in October this year. Work on the major foundations began in February 1957. The Laporte Central Research Department was responsible for the research and development of the new process and the design was carried out by the group's own engineering construction department.

Because of the increasing interest in hydrogen peroxide in the years since 1954, not only for use in bleaching and the manufacture of other per-compounds, but also for use as a propellant and as a reagent in organic synthesis, a great deal of work has been carried out on methods of manufacture other than the electrolytic processes developed over the last 50 years. That which has received the most attention has been the use of organic intermediates, particularly substituted anthraquinols, which autoxidise to form hydrogen peroxide.

I.G. Farbenindustrie in Germany carried out the early work on such a process, which was taken to the pilot plant scale during the war years. The intermediate used was 2-ethyl anthraquinol which in solution was autoxidised yielding hydrogen peroxide and the quinone. After separation of the hydrogen peroxide by aqueous extraction the quinone was catalytically hydrogenated to the quinol and the solution was recycled.

The original German process has been further developed since 1945 by companies operating in a number of other countries and several processes are now in use. Among the companies active in this field have been Laporte Chemicals Ltd.

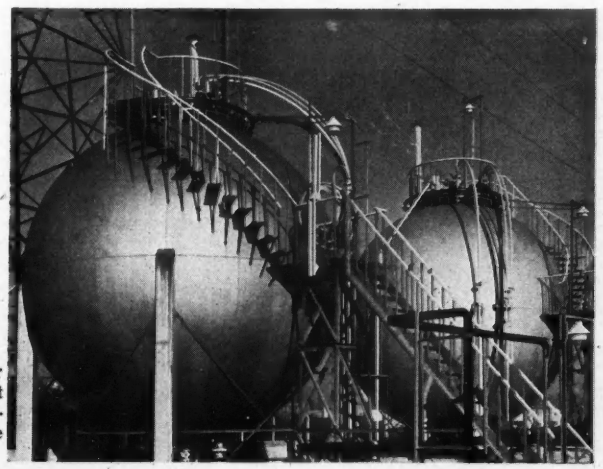
It was found that in general solvents for anthraquinones were not good solvents for anthraquinols and the processes were normally operated using a mixture of quinone and quinol solvents. The early process employed a mixture of benzene and secondary alcohols: proposed alternatives, use of which could improve the economics or reduce the hazards of a process, have included among others diisobutyl ketone, methyl naphthalene, cyclohexyl esters, ketones, chlorinated hydrocarbons and aromatic alcohols and their esters as components of solvent mixtures. Laporte Chemicals have not released details of the solvent mixtures they employ.

Raney nickel was used as the hydrogenation catalyst in the German process, but this suffers from the disadvantage that it is easily deactivated by dissolved oxygen or hydrogen peroxide and is pyrophoric. Later published work, however, has covered the removal of these oxidising agents and the use of supported nickel catalysts. A number of patents have described the use of palladium on an inert support as the hydrogenation catalyst, these supports including alumina, silica gel and certain silicates, and calcium phosphate. A major advantage of these catalysts is that any palladium oxides formed are reduced to the metal by hydrogen at ambient temperature.

The catalysts are not completely selective and some nuclear hydrogenation occurs resulting in the formation of tetra-hydro anthraquinones: other by-products may also be formed which take no useful part in the reactions involved. Methods have been proposed for controlling these side reactions which depend on modifying the conditions in the hydrogenator and the working solution. A number of processes have been described for the dehydrogenation of the tetra-hydro anthraquinones and for the reformation of useful anthraquinones from the further degradation products. The hydrogenation may be carried out using a fixed bed of massive catalyst or with a catalyst suspended mechanically or by means of a stream of hydrogen.

The autoxidation reaction is non-catalytic and proceeds readily although the tetra-hydro anthraquinols react more slowly than the normal anthraquinols. The use of packed column reactors has been proposed, and formation of by-products is minimised by restricting the residence time in the reactor.

Extraction of the hydrogen peroxide from the organic phase may be carried out using counter-current columns, yielding aqueous solutions containing up to 35% H_2O_2, although tthe use of steam stripping has been described. Little in-



Horton spheres for butane storage at the new A.O. hydrogen peroxide plant

Laporte Chemicals' hydrogen plant at night

formation has been published on the further purification and concentration of these solutions: it is known that the product contains substances originating in the organic solution and these may be removed by extraction with a solvent. After concentration by distillation, treatment with a polymer containing an unsaturated ethylenic bond removes coloured compounds.

The process developed by Laporte Chemicals and now in operation at their Baronet Works is based on the use of 2-ethyl anthraquinone, supplied by Imperial Chemical Industries Ltd. It was developed by their research and development department at Luton, plant design work and construction being carried out by the group engineering construction department of Laporte Industries Ltd. in London. Main contractors for the plant were the Aluminium Plant and Vessel Co. Ltd., and Matthew Hall and Co. Ltd.

Hydrogen used in the process is made by cracking butane, obtained from Stanlow Oil Refinery, the plant being supplied and erected by the Power-Gas Corporation. In the presence of steam and a catalyst (not detailed), the butane yields hydrogen and carbon monoxide: the latter is removed by reacting with steam over a catalyst forming hydrogen and carbon dioxide. The carbon dioxide, removed by scrubbing with monoethanolamine, is used as required as a purge gas in the autoxidation process. The hydrogen is passed over a catalyst, when the carbon monoxide content is further reduced with formation of methane, and then compressed for use in the process.

Almost all the equipment is in the open, mounted on a concrete slab or in concrete bunds: components are fabricated in aluminium, aluminium alloys, stainless steels and stoneware. The plant is fully instrumented, all flows and pressures being automatically controlled.

The autoxidation process organic cycle consists of two identical units which operate in parallel up to the extraction stage where solution from both streams mixes. Hydrogenation is carried out in vertical vessels using palladium on an inert support in free suspension as the catalyst, which is being manufactured on the site. The catalyst is suspended using a stream of hydrogen which is passed through the reactor in excess of the theoretical requirement, the excess being reciculated together with fresh hydrogen. Catalyst is added to the reactor at the rate necessary to maintain the required rate of reaction. Hydrogenated solution passes through filters which retain the catalyst in the hydrogenator.

As both the hydrogenation and oxidation reactions are exothermic, the filtered solution is cooled before passing to the oxidisers. These are vertical vessels, and solution and air are fed to the base so that flow is co-current. The gas/liquid mixture leaving the top of the reactor is separated, excess air passing through active carbon beds for recovery of evaporated process solvents before passing to atmosphere.

Hydrogen peroxide is extracted from the organic solution using counter-current flow in columns 85 ft. high fitted with perforated plates. As the organic solution is less dense than water it is fed to the base of the columns. The aqueous feed is de-ionised water, prepared with mixed resin bed exchange units, to which a stabiliser and corrosion inhibitor are added. The aqueous product, which is withdrawn at a constant rate, contains approximately 18% H_2O_2; after passing through a treatment stage for removal of dissolved organic compounds it is held in run-down tanks for checking of quality.

The extracted organic solution passes to a storage tank before being returned to the hydrogenator. The process is thus continuous and cyclic, and it will be seen that the major raw materials are hydrogen, atmospheric oxygen and water.

The 18% H_2O_2 may be used directly for certain purposes, but it is normally further purified and concentrated to 50-90% hydrogen peroxide by distillation. Distillation is carried out on a site adjoining that of the organic cycle, and again the plant is largely in the open. The vaporisers are of the vertical tube and shell type with recirculation, the vapour/liquid mixture passing to a separator. The vapour is fractionated in a column using direct reflux, the columns either being fitted with West plates or packed with ceramic rings, to yield a product with a concentration maintained at the desired level in the range 50 to 70% (approximately 65%) H_2O_2. The overhead product, substantially water vapour, is condensed using jet spray condensers. Distillation is carried out at reduced pressure, the pressure being maintained using steam ejectors.

Part of the production from these stills is purified further and converted to 85 to 90% H_2O_2 (high test peroxide, or H.T.P.). Hydrogen peroxide solutions are delivered from site in 99.5% aluminium rail tankers, or by road in smaller containers.

This new air oxidation plant, much of which is constructed in aluminium is almost entirely built in the open. Care has been taken wherever possible to prevent corrosion occurring by separating the aluminium columns and piping from contact with the foundations and mild steel structures by the use of p.v.c. sheet and roofing felt. The erection was preplanned and shown schematically on a planning board. The large columns were among the first items of plant to be installed since they were transported to the site by road in one piece and had to be lifted into position using derrick poles and cranes.

Nearly all the pipe work was fabricated on site and this involved specialised training and supervision of the men involved in this work. Special attention has been paid to cleanliness of the equipment and much of the aluminium equipment and pipe work was 'pickled' after fabrication.

'Largest-ever' Vessels

The aluminium vessels were fabricated by the Aluminium Plant and Vessel Co. Ltd. All joints were Argon arc welded and this involved special techniques as the wall thickness of some of the vessels exceeded 1½ in. Valves on the solution system are of stainless steel and polytetrafluoroethylene valve packing has been used throughout to minimise loss of the expensive solvents and virtually eliminates gland maintenance. Where there is catalyst in the system 'Y' valves with seal wiping mechanisms are used. The valves were supplied by Joshua Hindle and Sons Ltd. of Liverpool.

The major vessels are believed to be the largest which have ever been fabricated in aluminium and include the extraction columns up to 85 ft. high and 12 ft. in diameter.

High speed rotary compressors used to supply air for the oxidation stage were supplied by James Howden and Co. Ltd. of Glasgow. These run with fine clearances between the rotor tips and casing. The drive speed is 1,480 r.p.m. which is raised through a speed increasing gearbox to a rotor speed of 5,880 r.p.m. These machines are capable of delivering more than 3,000 cu. ft. per minute at a delivery pressure of 40 p.s.i.

Hydrogen make-up compressors were supplied by Broome and Wade and are single-stage, double-acting dry cylinder

machines fitted with gas proofed autogovernors and unloading equipment, and carbon piston rings and carbon glands on piston rods. These machines are capable of delivering about 400 cu. ft. per minute at a delivery pressure of 50 p.s.i.g. Nash Hytor compressors are used for recycling hydrogen in the system. These machines are in cast iron with liquid seals. These compressors are capable of delivering approximately 400 cu. ft. per minute at a delivery pressure of 35 p.s.i.g. There are 14 pumps in use for circulating solution and these were supplied by Hayward Tyler (Byron Jackson. They are fitted with Flexibox mechanical seals. LaBour self-priming centrifugal pumps are used throughout for pumping hydrogen peroxide. These pumps are constructed in aluminium alloy.

The plant used for recovery of solvent from the oxidiser off-gas has been supplied by the British Ceca Co. Ltd. It consists of four vessels which are packed with activated carbon. Two of the vessels are on line at one time, the others being reactivated by steaming.

An interesting feature of the plant is the use made of aluminium/tin foil as lagging material supplied by Newalls Insulation Ltd.

Control Panel

The whole of the air-oxidation plant is controlled from a 22 ft. long central control panel divided into three sections; a graphic representation of the plant with miniature instruments indicating physical values of flow, level, etc., an alarm section, and a more conventional panel which carries instruments measuring temperatures, gas analyses and tank contents. Owing to the inflammable nature of the liquids and vapours in the plant, pneumatic instruments have been used wherever possible.

Flow metering is by differential pressure transmitters, using orifice plates as primary elements. Flow controllers are three term, force balance type, mounted local to the control valves. The receivers are all fitted with auto/manual facilities. Differential pressure transmitters have also been used for pressure measurement in a number of the process vessels. Levels are controlled by means of displacer type level controllers each of which is fitted with two separate pneumatic systems. One system is used for control and the other for transmission to ribbon type indicators in the control room.

Control valves range from ½ in. bore, bellows seal, single seated valves up to and including 10 in. double seated, stainless steel control valves, each weighing some 900 lb. All diaphragm-operated valves above 2 in. are fitted with valve positioners. Conventional 3-way control valves with quick acting characteristics are used for certain purposes, but these are driven by power cylinders instead of diaphragm motors. The power cylinders are fitted with pilot valves. All control valves throughout the plant are fitted with p.t.f.e. glands.

Instrument air is supplied by reciprocating compressors of which one is in service and the other on automatic stand-by. A third compressor, normally used for supplying air for pneumatic tools can, in emergency, be coupled into the instrument air system as an alternative spare. A large air receiver having a capacity sufficient for approximately one hour's supply for all instruments on the plant is automatically drained and is followed by an activated alumina air drier. The air has a dew-point lower than any atmospheric temperature likely to be experienced in this area.

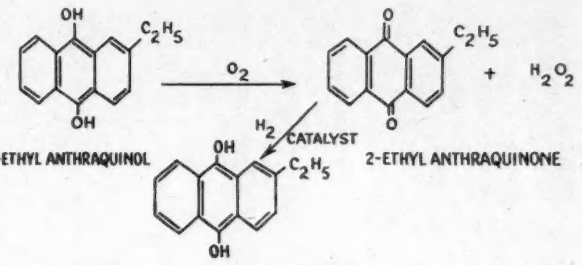
Alarms operate from tank levels, interface levels, low pressures and gas analyses.

Tank contents are measured generally by standpipe air reaction instruments, although in a few cases force balance transmitters have been used in conjunction with ribbon indicators on the graphic panel. Temperatures are measured by means of electronic Wheatstone bridge indicators and recorders using platinum resistance thermometer elements. Oxygen content in the gas phase in various parts of the plant is critical and a total of seven oxygen analysers is employed in the plant. These are of magnetic wind type and vary in range from 0-20% oxygen in nitrogen to 0-3% oxygen in hydrogen.

Experience with the plant, so far, indicates that maintenance is not likely to be a very serious problem and it is expected that the whole of this plant will not require more than an additional two mechanics in the instrument shop.

Total installation cost, including materials, instruments and labour was approximately £75,000.

Anthraquinols autoxidise to yield hydrogen peroxide **(see p. 895)**



Letters to the Editor

Johnson Matthey's Work on Gallium

SIR,—The Editorial in your 1 November issue of the CHEMICAL AGE has been read with interest. You will recall that it deals with the investigational work being carried out by the National Chemical Laboratory at Teddington.

Reference is made to substances in which we are very interested as producers and suppliers, consequently we trust you will appreciate the spirit that prompts the following comments.

During recent years we have devoted much capital, research, time and labour to the recovery and purification of gallium from indigenous raw material and we feel compelled to express concern because the price you have mentioned about £1 per gramme) is substantially higher than that at which we are selling (8s. per gramme for minimum quantities of 1 kilogramme having a minimum purity of 99.99%) and could be a deterrent on economic grounds to readers who might be contemplating its application. We should have been grateful for the opportunity to advise you of our price basis before the article was printed.

Unfortunately your statements give prominence to German, American and French production without reference to established British production and we feel sure you will be interested to know that we are supplying gallium not only in terms of kilograms but to the very German producers to whom you refer. We are also supplying substantial quantities to America.

The isolation and production of all the rare earths over a wide range of purities has been established practice within our organisation for a number of years. More recently, not only have we produced these oxides, but we have been producing in addition 14 of the rare earth elements in a state of high purity. In this field, therefore, industry may rightfully claim the lead.

L. E. HOLLAND,
Manager, Chemical Division.
Johnson Matthey and Co. Ltd.,
73-83 Hatton Garden,
London, E.C.1.

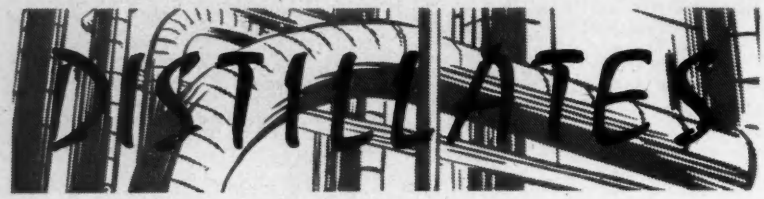
(Priority is always given in CHEMICAL AGE to the achievements of the British Chemical Industry. On the occasion of the N.C.L. Open Days, however, no information was made available on the contribution being made by U.K. firms in the development of gallium.—*Editor.*)

Brussels Anomalies

SIR,—With reference to 'Alembic's' paragraph on the new Tariff and 'Classification of Chemicals in the Brussels Nomenclature' (Distillates, 8 November), chemists must have had something to do with the drawing up of the classification, but how boron trifluoride got into 28.14 (halides, oxyhalides and other halogen compounds of *non-metals*) and arsenic disulphide into 28.15 (sulphides of *non-metals*) is a mystery. How did silicon and selenium get into 28.04 (hydrogen, rare gases and other *non-metals*)?

Yours etc.,

J. C. WILLIAMS,
Director.
Toxane Ltd.,
Edgware, Middx.



★ USE OF Malathion for stored food protection, already approved by the U.S. and Canadian governments, has now been officially accepted by the Ministry of Agriculture. Malathion, developed by Cyanamid, is extraordinarily safe to humans and animals but lethal to insects. Preventing the loss of as little as 0.25% of the 17 million tons of grain and oilseeds annually used in the U.K. would save at least £1 million.

I am told that laboratory tests have shown that animals can eat relatively large quantities of Malathion for several years without harm. But only minute amounts are needed to kill common insect pests. Under the new regulations, the Ministry permits the addition of 10 oz. per 1,000 bushels of any grain or oilseed.

The insecticide can be mixed as a powder or liquid with the grain or sprayed on bags, the walls of storage silos and ships' holds. Costs are said to be 4d per ton of treated grain.

★ PRODUCTION of solar salt is still expanding, and not only has it captured much of the former British export trade, but has taken much of the fishery salt business in U.K. home ports. Since I.C.I. began to sell dendritic and granular grades of vacuum salt, there has been a big reduction in the sales of open pan salt, which in 1949 totalled 149,000 tons. Although by 1957, open pan sales had fallen to 66,000 tons, total sales of I.C.I.'s Salt Division were higher than in 1949.

This was stated recently by Mr. E. H. Sale, the division's managing director. Referring to the company's decision to stop producing Lagos salt, Mr. Sale said they believed that sooner or later, the West African would realise that vacuum salt would flavour his stew as well as 'Lagos' even though it looked different; if vacuum were cheaper he would choose it.

Sales of dendritic salt have in fact made steady progress in West Africa in recent years, though the rate of progress has been slower than the division would have liked. Taking the long view, Mr. Sale believes that I.C.I. prefer to put their money in vacuum salt.

★ THE USE of an EMIAC 1 analogue computer by Laporte Chemicals in the design of their autoxidation plant (see p. 895) enabled the design work to be completed with confidence that no major mistakes had been made either in vessel capacities or in the arrangement of the controller systems. The degree of accuracy of this work has not yet been determined as far as plant response times are concerned, but as the plant did not give any unexpected trouble during start-up, it is believed that the numerical data were at least reasonably accurate.

After control schemes and vessel sizes, etc., had been determined, a representation of the process was set up on the computor. Information given confirmed that there would be no serious interaction between the various automatic controllers. It also gave figures for the optimum control settings of all controllers.

The vessel sizes chosen were shown to be sufficient, in conjunction with the control settings, to take care of all expected throughput changes. Information was given as to the time it would take the plant to settle down after major disturbances and the knowledge was provided that periodic disturbances, introduced as part of the process, were not likely to be of frequencies which would lend to hunting throughout the plant. It was shown, too, that oscillations, which might be introduced by hunting of the gas phase controllers, were unlikely to induce hunting on the whole plant.

★ MR. HUBERT OUGHTON, chairman of W. S. Crawford Ltd., the well-known advertising agents, is president of the National Advertising Benevolent Society for 1958-59. The society's annual appeal for funds is now being made and under the leadership of Mr. Oughton some of the best brains in advertising have collaborated in producing a most striking and effective brochure. 'This is what NABS does.'

Business men of all kinds who are interested in the techniques of publicity should send for a copy to the general secretary, National Advertising Benevolent Society, 27 Old Bond Street, London W.1. As the saying goes, 'there is no obligation,' but a guinea to N.A.B.S. would be a small price to pay for this masterpiece.

★ THE EFFICIENCY of the Solidrum reinforced 45-gal. steel drum made of lighter weight metal than normally used was tested by air pressure during recent studies made by Patra workers (Printing, Packaging and Allied Trades Research Association). The walls and ends of the drum are of 20-gauge metal and the seams of both top and bottom climbs have special 6-gauge reinforcement. Rolling hoops also have extra strength.

Patra tell me that the results of drop, rolling and internal air pressure tests showed that these drums were 'as good as, if not somewhat better than, the standard drums made with 18-gauge metal.' Drop tests showed that this drum suffered considerably less visible damage in the way of buckling than did standard design drums in material of 20-gauge body and 20-gauge ends and were only deformed to about the same extent as the heavier 18/18 drums.

The internal air pressure test showed that the reinforced drum was more resistant to deformation and leakage than any of the standard drums tested. It proved to be satisfactory up to the highest pressure used (20 p.s.i.) while the others failed at pressures of 15 p.s.i. or less.

★ AN INTERESTING tail-piece to the opening of the new chemical laboratories at Cambridge (see CHEMICAL AGE 15 November, p. 808), is the fact that for his work in equipping and building them, Mr. A. Ralph Gilson was awarded the M.B.E. in the Queen's Birthday Honours.

Mr. Gilson is managing director of Perkin-Elmer Ltd., 160 Cheapside, London E.C.2, the U.K. manufacturing subsidiary of the Perkin-Elmer Corporation, Norwalk, Conn. He was formerly executive director of the laboratories for 13 years. The new chemical laboratories are the largest and considered to be the finest academic laboratories in the world.

★ ANOTHER end-use for that versatile polymer polythene has been announced by British Resin Products. Lightweight, unbreakable stencils said not to warp, buckle or degrade are now being produced by Heller and Sons (Engineers) Ltd., 51 Turnpike Lane, London N8, from sheet extruded from 'Rigidex Polyethylene.'

Cut from 0.020, 0.025 or 0.030 in sheet depending on the area of the stencil and the size of the lettering, the new stencils are essentially rigid, although they will readily flex to fit virtually any contour. Extremely durable they are also claimed to be rot-, rust- and corrosion-proof. Unlike metal stencils they have no sharp edges and the small areas left uncut to preserve the configuration of the letter or motif, are strong and will not split or tear. The Rigidex stencils retain their flatness and never need to be straightened out.

Because polythene is inert, the stencils are simple to clean and stencilling ink in solid or liquid form can be readily washed off, while paint can be wiped away.

Alembic

LATE NEWS: Referee finds for B.o.T. Polymers properly excluded from K.I.D. List

Q.C. Quotes Chemical Age Article on Cellulose Acetate at Polymer Tribunal

CHEMICAL AGE was quoted at the Polymer Tribunal when Sir Lionel Heald, Q.C., for the complainants, began his cross-examination of Sir Christopher Ingold, professor of chemistry, University College, London. Sir Lionel asked him to examine an article published in 'Chemical Age' of 19 February 1921. Under the title 'The future of our key industries,' the article gave the opinions of representative British manufacturers. In particular Sir Lionel quoted from comments by Dr. Henry Dreyfus, British Cellulose and Chemical Manufacturing Co. Ltd. (now British Celanese).

The tribunal, under Mr. A. W. Roskill, Q.C., referee, completed last week its consideration of the complaint that four polymers—polythene, polystyrene, p.v.c. and polymethyl methacrylate—were improperly excluded from Key Industry Duty List J. Other reports of the tribunal appeared in C.A., 15 November, p. 797, and 22 November, p. 849.

The complainants, Bakelite Ltd., Distillers Co. Ltd., Imperial Chemical Industries Ltd., and Monsanto Chemicals Ltd., were represented by Sir Lionel Heald with Mr. S. Gratwick. Mr. K. Johnston, Q.C., with Mr. R. Winn appeared for the Board of Trade. Mr. J. P. Graham, Q.C., with Mr. G. D. Everington for the opponents: Anglo-American Plastics Ltd., British Cellophane Ltd., Chiltern Hunt Ltd., Henry Jackson (Liverpool) Ltd., Metal Box Co. Ltd., and Armoride Ltd., Commercial Plastics Ltd., Duraplex Plastics Ltd., Rubber Improvements, Stanley Smith and Co.; Storeys and Wallington Weston.

Sir Lionel, questioning Sir Christopher, a witness for the Board of Trade, quoted from the remarks in CHEMICAL AGE of Dr. Dreyfus as follows:

Because of the serious shortage of solvents for cellulose acetate, British Cellulose undertook to supply the necessary solvents in large quantities. Erection of the plants for the production of these chemicals involved an outlay of £1.5 million in addition to the cellulose acetate plant which cost over £1 million. It was only the existence of these works that had made Great Britain independent of overseas supplies, particularly during the war years.

Sir Christopher said he had not realised that in 1921 production of cellulose acetate and solvents had developed to such an extent.

Sir Lionel suggested that Sir Christopher's definition of the words 'synthetic organic chemical' would exclude cellulose acetate and he asked him if he could think of any of the objections that Sir Christopher had raised against any of the other polymers, which would not apply to cellulose acetate. Sir Christopher said no, he thought it had to come in.

Was there anything which was in argument that was applicable to the polymers in question? asked Sir Lionel, and Sir Christopher suggested that cellulose acetate was slightly more marginal in that it was synthetic only 'round the coat'.

A little later Sir Lionel took Sir Christopher through the definitions of ethylene, polythene, etc., as given in Heilbron. Sir Christopher indicated that if it was expected that the compiler of a dictionary stuck to his title really strictly, he could not agree. No harm was done by including something that was related to the subjects strictly covered by the title.

It was then pointed out to Sir Christopher that the B.o.T. had included cellulose acetate in the list for 30 years, to which Sir Christopher said he thought he would not be quite so willing to make excuses for the B.o.T. as he was willing to make excuses for Heilbron.

Later 'Chambers Encyclopædia', 1950 Edition, was produced by Sir Lionel (p. 377, of Vol. 3) and information contained therein on the subject of polythene, petroleum constituents, resins and plastics, was confirmed by Sir Christopher; in particular, he did not consider heretical statements made by Dr. W. A. Waters, in the encyclopaedia on chemical change, polymerisation, etc.

Reference was made again to CHEMICAL AGE, 19 February 1921, and the comments made by Sir Edward Brotherton of Brotherton and Co., regarding the monopoly in the manufacture of fine chemicals.

Sir Christopher's reference to Bakelite during Mr. Graham's examination was questioned by Sir Lionel. He wondered if Sir Christopher had meant Bakerite which was a famous explosive in the first war, but Sir Christopher said he had meant Bakelite. Sir Lionel suggested that Sir Christopher was talking about something a little bit out of his line. On his part Sir Christopher said he had been concerned at the time about the amount of Bakelite produced around 1921. In 1919, said Sir Lionel, Bakelite, namely Damard Lacquer Co. Ltd., were producing cast resin in quantities of half a ton a week. T.N.T., however, and nitrotoluene and nitrotoluol were produced; T.N.T. in quantities of about 50,000 a year and these substances had been included in the Safeguarding of Key Industries 1921. This rather militated against the idea that the Act only covered

. . . from C.A., 19 February 1921

210 The Chemical Age February 19, 1921

The Future of our Key Industries

Opinions of Representative British Manufacturers

Mr. T. Lester Swain

Dr. Henry Dreyfus

Sir Lionel Heald quoted from 'Chemical Age' when examining Sir Christopher Ingold. He referred to this article in C.A., 19 February, 1921, which summarised, before the passing of the Safeguarding of Industries Bill, views of leading chemical industries personalities on the future of British key industries

'Strictly Speaking Paraformaldehyde Ought Not to be on List'—Ingold

fine chemicals since T.N.T. would not be regarded as a fine chemical, with which statement Sir Christopher agreed.

Cellulose acetate had been and still was on the list, a period of 37 years. Imports at present amounted to some £2 million a year and import duty totalling many thousands of pounds had been paid upon it. Sir Christopher said he did not exactly understand the position. He thought that the original inclusion of cellulose acetate was a mistake.

Sir Christopher had spoken of the expression polythene involving 'a series of things'—a generic term. Had he considered, asked Sir Lionel, the definition which had been agreed in the Brussels Nomenclature? Sir Christopher said he had heard of it but not seen it.

Sir Lionel then referred to the Brussels Nomenclature along the lines of those of Mr. Johnston (C.A., p. 849). He read 39.02 dealing with polymerisation and copolymerisation products. He asked Sir Christopher's opinion of it for the purpose of arranging international tariff systems, as for example for a free trade area. Sir Christopher said he would not think that it would give rise to many difficulties. In response to a question from Sir Lionel on whether 39.02 would cover polythene, he thought they would all come within this class. If a particular copolymer was left out it did not matter, because those given were examples only, and were not an exhaustive list. He would have thought that it would be possible to determine whether a product fell within the general class of goods comprised within the term 'polymerisation and copolymerisation products'. If it was a copolymer or a graft polymer, e.g. polystyrene and polyisobutylene, he thought it would be picked up by testing techniques.

. . . 'Do I understand you to say that as a chemist, if you were asked to advise the Government, the B.o.T., as a technical expert in these matters, as to whether heading 39.02 could be satisfactorily applied for the purpose, I understood that you agreed it could be?'—'I think so. Just thinking quickly, I cannot conceive of any difficulty.'

Formaldehyde

Dealing with S.I. 2308/1949, p. 18, 'Formaldehyde', from the point of view of the Brussels Nomenclature, Sir Christopher said he supposed that it would be workable, but he was not so certain about it, because the aldehyde-amine polymers included a few other definite low molecular weight ones, and what else they included was not so very clear—melamine, for instance, was a polymer of that kind. He supposed the B.o.T. had gone into it, and that they had decided that 'this kind of collectivisation of a rather miscellaneous bag of things' was 'all right'. They might have had difficulties because of the length of the list.

Sir Lionel stated that paraformaldehyde had been on the K.I.D. list since 1921. Sir Christopher agreed it was an addition polymer, and that it was of the same type as polycaprolactam (nylon 6). Strictly speaking, Sir Christopher said, paraformaldehyde ought not to be included in the list. The only thing that could be said in extenuation of it, was that it was bought because formaldehyde could be obtained from it very easily. A cylinder of formaldehyde would polymerise, so the best way of packaging it was to polymerise it. Then as much dry formaldehyde as was desired could be obtained.

It would be very unsatisfactory to have on the list polymers which were easily transformed into the monomer, Sir Lionel suggested and Sir Christopher agreed.

Yarsley Quoted

Sir Lionel then passed to oxamide, on the list in 1921, which had the formula $(CO.NH_2\ CO.NH_2)n$, a similar formula to those of the polymers in the case. Sir Lionel's information was based on recent work. Many other items on the list such as heparin, amyl alcohol, crystalline principles obtained from aloes, citronella oil, sodium morrhuate, were considered. Reference was made to Dr. Yarsley's book and considerable discussion took place between Sir Lionel and Sir Christopher. Sir Lionel suggested that some of the rather recondite matters that had been discussed would not be regarded by Dr. Yarsley as being essential and Sir Christopher agreed. Also that the only difference between Sir Christopher and Dr. Yarsley was that he had said long-chain giant molecules were synthetic organic chemicals or compounds. Sir Christopher said he stated that they comprised them; they were mixtures of them. Then said Sir Lionel there was a difference in approach between Sir Christopher and Dr. Yarsley taken as the representative of a group of very highly-skilled chemists who had devoted themselves particularly to the plastics industry. There was a difference between Sir Christopher and eminent colleagues of his in the organic chemistry field. Sir Christopher confirmed this.

Summarising Sir Christopher's evidence on day 5 of the hearing, Sir Lionel said that the difference of view between Professor Bawn and Sir Christopher might really be said to come down to the following: that whereas he said that polystyrene, for example, was a synthetic organic chemical, Sir Christopher had said that it ought not to be described as anything more than a mixture of synthetic organic chemicals. Sir Christopher agreed, but qualified this, saying it should be described as a mixture of organic chemicals, 'because with the term "organic chemicals" I use "synthetic" in the other restricted sense'.

Sir Lionel said that the contrast was between the mixture of chemicals and the chemical and Sir Christopher confirmed this. 'You approached it from this point of view: first of all chemicals should be regarded as chemical compound?'—'Yes, chemical compound.'

'And secondly that the word "compound" should be considered in the strict rather than from the broader sense that we saw in "Chambers Encyclopaedia"?'—'Yes.'

'Therefore we arrived at this point, that there were those two contrasting views as to how polystyrene should be described, and you agreed that they were both views which could be taken by serious chemists—and we used the word 'serious', you remember?'—'Yes.'

'And I suggested to you that one of them was more consistent with the nature and the purpose of the Act than the other, and we discussed that?'—'Yes.'

'Therefore we were proceeding yesterday on the basis that there might be two alternatives, and that one of them was preferable for the purpose of the Act, although both of them academically might be regarded as at any rate competitors in the field. Would that be fair way of putting it?'—'I think it would . . .'

'Never Used in that Way'

Sir Christopher considered that plastics chemists do broaden the word, but it was not until the tribunal began that he had even suspected that; because he had never heard it used in that way before.

'Then the position is this, is it, that if the plastics chemists came along here . . . ?'—'Yes.'

'You would expect them to say that these things were chemicals?'—'Yes, they have been saying it, you see. I am getting used to it now.'

'They have not been saying it in their case, so it would be rather interesting to see if any of them do come here and say that would be entirely contrary to their written pleading.'

It was pointed out to Sir Christopher that on p. 53 of Yarsley's book there was the statement 'All plastics are organic compounds'. Sir Christopher said he would have expressed that as 'All plastics consist of organic compounds', not 'are organic compounds'.

'. . . Did I understand you to say that you would expect the chemist or expert doing this sort of work that Mr. Couzens and Dr. Yarsley are doing, as described in this book . . . to describe these products, including these polymers, as organic compounds?'—'I now would, you see, since yesterday . . .'

'That is all.'—'You have convinced me of something.'

A little later Sir Lionel said: 'I understood you to say yesterday that the

meaning of these terms, definition of a term such as organic compound had not changed today, as between today and 1921?'—'I do not think it has.'

'Now it is perfectly clear, is it not, that Mr. Hickinbottom, in this article in Volume 3 of Chambers Encyclopaedia, was in fact describing these polymers as compounds, and they are organic; there is no doubt about them being organic?'—'There is no doubt about that, no.'

A quotation from the appendix in Rutger's 'Physical Chemistry', 1953, by Turner Alfrey (author of 'Mechanical properties of high polymers' and 'Copolymerisation') was read to Sir Christopher. Alfrey's book, Sir Lionel said, was stated by Professor Bawn to be a standard book in the study of polymers.

> 'All the fundamental principles of molecular structure, thermodynamics and kinetics, which have been established in the low molecular weight domain apply in the field of natural and synthetic high polymers. On the other hand, many of the most familiar working equations of traditional physical chemistry are based not only upon sound fundamental principles but also upon special assumptions (sometimes implicit) as to the low molecular weight of the material; such equations may fail dramatically when applied to high polymers. The polymer chemist must always be prepared to replace these equations which are based on the same fundamental considerations, but which are specifically adapted to high polymeric substances.

Sir Lionel asked Sir Christopher whether having read that, he would agree that the view which was taken by those scientists, who had devoted particular study to this question of polymers, was really that the thinking and methods of organic chemistry had to undergo a certain amount of modification in detail in order to deal with those new substances? Sir Christopher said he did not quarrel with what they said.

Modification of Ideas

'. . . I was going to suggest . . . that those like yourself who have not made a particular study of this matter perhaps do not appreciate that it is necessary to go through a certain amount of modification of one's ideas and thoughts and general approach when dealing with this new subject?'—'Sir, I do claim that I have studied statistical mechanics, and I have studied rather carefully one of the most important books upon those modifications of theory of which you speak, namely the book by Paul Flory, called 'The Chemistry of High Polymers' . . . and I am very interested in chemical principles and these are chemical principles, and so I am interested in all this.'

'. . . I am not suggesting for a moment that it was any criticism upon you that you were not a specialist in this subject, people cannot be specialists in everything?'—'No, I have certainly never contributed by my personal researches to the new knowledge of polymers. The nearest I have got to it is to advise other people . . .'

Returning to 'Chambers Encyclopaedia', Vol. 3, 1950, p. 358, Sir Lionel said that in his article Hickinbottom referred to the polymers, particularly polythene under the heading of 'Aliphatic Compounds'. Sir Christopher had said that if that was what it meant, he did not agree with it. Sir Christopher denied this.

Continuing, Sir Lionel said that Sir Christopher had indicated that there was no substantial change in the meaning of these words as between 1921 and the present day.' Not what I call common user meaning,' stated Sir Christopher.

In response to an enquiry from Sir Lionel concerning the B.o.T. having done their best to find relevant documents which supported their case, Sir Christopher said he would not be surprised if they had been in the position as he was before last week, of not believing that there was in common currency usage among chemists of all kinds and of all English-speaking nations, regarding the use of the word 'chemicals'.

That, suggested Sir Lionel, put the tribunal in a little bit of a difficult position when these things existed and were not produced. Sir Christopher agreed.

'I suggest that the reason they have not produced any document of that kind was because it could not be found'.

Synthesis of phenol and acetone from cumene was discussed. Following through from cumene it was possible to have a mixture of phenol and acetone, which could readily be divided up into its two component parts. From the viewpoint of an importer, Sir Lionel suggested, that knowing phenol was subject to duty and likewise acetone, he could submit to the Customs a mixture of phenol and acetone. From Sir Christopher's view of the words 'synthetic organic chemical' that would be quite a good idea for the importer to do that, because he would be able to say 'This is not a synthetic organic chemical but a mixture of them'.

Sir Christopher said that the effect of it was that that mixture of phenol and acetone, when unseparated, was a mixture of compounds. He would have to say that it was a mixture of compounds when he submitted it to the Customs. 'I would hope that there are some legal safeguards, about which I am not competent to speak, which would stop him getting away with that.'

Sir Lionel asked that Sir Christopher assume that there was a construction in the Statute and the meaning that would result in the thing being effective was adopted, and if there were an alternative the alternative was taken, that ensured that some duty was paid rather than the alternative which avoided duty being paid. The Act in question did not do that at all. It said 'all synthetic organic chemicals'.

Later Sir Lionel said 'I will put it in this way—if the words "synthetic organic chemicals" are given proper force in this Act there is sufficient safeguard to cover the point you mention'—Sir Christopher said he honestly didn't know.

Yearbook Definitions Criticised in Sir Christopher's Re-examination

RE-EXAMINING Sir Christopher Ingold, Mr. Graham returned to the 'Plastics Yearbook' (presented during Sir Lionel's examination of the witness) to see if it could be put in the proper perspective. He had been told that it was very inaccurate in a very large number of places. In particular he asked Sir Christopher to look up 'polystyrene' because there was a reference to a reaction which was not in fact correct (p. 623).

> 'Transparent thermoplastic obtained by the polymerisation of styrene. The latter is prepared by the reaction of ethyl chloride and benzene giving ethyl benzene which is pyrolized to form styrene.'

Was this right, asked Mr. Graham? As he understood it that was a reaction which could be carried out. Sir Christopher said they would not do it that way. That would be too expensive.

With regard to terephthalic acid, it was stated in the Yearbook that this was formed by heating an alkali metal with phthalic acid.

Sir Lionel interrupted at this point to say that he had been instructed that that was a commercial method.

Mr. Graham: 'It may be. My instructions are to the contrary.'

Sir Lionel: 'Or at any rate has been.'

Sir Christopher: 'I will not criticise it. It just surprises me.'

The definition of 'condensation' was next considered (p. 617).

> 'Type of polymerisation reaction in which the molecules react with the elimination of a small molecule such as water.'

Mr. Graham said he had been told that the description in fact related to what was known as polycondensation, with which Sir Christopher agreed.

'And condensation itself need have nothing to do with polymerisation?'—'Absolutely, you are quite right. This is quite wrong.'

Sir Lionel: 'Could it be explained in what sense the word condensation is being used? Is it being used in the chemical sense, or in the sense of drops of water? Professor Bawn suggests I should ask that question.'

Mr. Graham: 'If the witness heard the question?: It is not condensation in the sense of gas condensation to a liquid. It is a type of polymerisation reaction.'

The definition of copolymers was considered by Sir Christopher to be about right. Mr. Graham suggested that that was not the sort of book he would go to, and Sir Christopher said he thought it would be pretty loose.

The formula of oxamide had been raised during Sir Lionel's examination of Sir Christopher. Mr. Graham handed Sir Christopher Bernsthen's 'Organic Chemistry', 1946 (p. 271), and Sir Christopher said the formula given there was as he thought it was. From what Sir Lionel had said it had now been

discovered that the formula might not be accurately represented and that it had been shown that it had a much more complicated body. Sir Christopher said it was something he had not caught up with.

The referee questioned Sir Christopher at the end of his evidence, on his reply to Mr. Graham regarding the expression 'synthetic organic chemicals' having a technical meaning. Sir Christopher had said that the phrase had not changed its meaning for a very much longer period than the period between then and now; it had had a constant meaning for a very long time. The referee asked whether he would develop his answer in any way and explain why and over what period of time this expression had had the technical meaning to which he referred.

Sir Christopher said that the nature of chemical compounds had been rather clear since 1808, and then the meaning of synthesis, he thought, had been rather clear since about 1840 or 1850, and it could be put back 10 years behind that. 'Organic' got its modern meaning at about the same time, about 1832; he thought the whole thing had hardly changed since 1840.

Case Hinges on Definition of 'Synthetic Organic Chemicals', Q.C.

SPEAKING on behalf of his clients, the opponents, Mr. Graham in his final submission said that the question in the case was very simply stated, and it was: Are these disputed polymers, synthetic organic chemicals within the meaning of the Act of 1921 on its proper construction? That was the question that the tribunal had to decide, and the importance of stating the question was to emphasise that it was the phrase 'synthetic organic chemicals' as a whole which was to be considered. Neither the meaning of the word 'chemical', the meaning of the phrase 'organic chemical', nor the meaning of 'synthetic' was to be considered. It was the meaning of the whole phrase used as a phrase in the Act of 1921.

Having decided that, there really would be no difficulty in deciding the question as to whether or not the polymers (polythene, polystyrene, p.v.c. and polymethyl methacrylate) fell within those words on their proper construction.

Reference was made by Mr. Graham to Dr. Cook's evidence on analytical reagents when he agreed that these were regarded as included within the term 'fine chemicals' and that they included both inorganic and organic chemicals. Those produced by synthesis would properly be called 'synthetic organic chemicals' or 'synthetic organic chemical compounds'. The questions to Dr. Cook had been directed to founding the proposition that the expression 'fine chemicals' was a technical term, included chemicals which were neither analytical reagents nor synthetic organic chemicals, but which were produced in a high state of purity and therefore almost certainly not produced on any very large scale.

The tribunal was entitled to and indeed had to understand what was the position of the chemical industry (in its broadest sense) and the plastics industry in 1921. First of all, there was the position of the fine chemical industry in 1921 and the position of the plastics industry which at that time, largely consisted of Bakelite, Celluloid and Erinoid. Secondly, there was the position of the plastics industry. Contrary to it being 'a scion of the chemical industry' the evidence was that it was the other way round. It was not the chemical industry that had started the plastics industry. The industry had started on its own. This was made clear in the Bakelite book. The industry used the chemical industry for their raw materials—they were using products such as formaldehyde; but 'they were not the children of the chemical industry, they were the customers of the chemical industry'. I.C.I. and similar large groups, realising that there was a great future in the plastics industry, 'horned in on it'. They had absorbed the small companies and developed them to their present giant size.

Of the position of the fine chemical industry, Mr. Graham said that at the end of the first world war it was small. In 1921, it was in a very tender state. Mr. Graham's argument was that if the words 'synthetic organic chemicals' were restricted to fine chemicals, that was an end of the case, because so far as the polymers in question were concerned, nobody suggested they were.

The referee at this point asked Mr. Graham to suppose that. Mr. Graham said that if it were not limited to fine chemicals then it was not relevant to that part of the argument. The referee stated it was not; so that that part of Mr. Graham's argument was only relevant if 'synthetic organic chemical' had to be a fine chemical.

There were two limitations on that section: first, that it was limited to 'fine chemicals', and secondly that it was limited to 'synthetic organic chemicals'. in the meaning of a chemical which could be accurately specified and defined as having an accurate formula.

In 1921 there were the two main branches of the chemical industries—the heavy chemical industry which it was not necessary to protect as it was producing on a very large scale and the small synthetic organic chemical and fine chemical industry which required protection. On the other hand the plastics industry, which was taking chemicals from the chemical industry to use as its raw materials, had been running, although not a very big scale, for many years, i.e. from about 1910.

Mr. Raine's evidence (see CHEMICAL AGE, 15 November, p. 801) had shown the present tonnage of the polymers in question. The import figures for these polymers into this country were then given by Mr. Graham. The annual figures were agreed figures. They were not of guaranteed accuracy, but were a good guide: p.v.c., 12,000 tons a year; polythene, 4,500 tons; polymethyl methacrylate, 1,500 tons; polystyrene (actual figure), 715 tons.

The total was about 18,700 tons a year, which worked out at 5 tons a day, 10% of the production in the U.K. The Act of Parliament, said Mr. Graham, was quite clearly intended to deal with an industry which needed protecting, namely, the fine chemical industry. If in 1921 somebody had suggested the Act should have been applied to an industry which was producing on the scale of 160,000 to 170,000 tons a year, he thought 'Parliament would have blown up'.

The referee: 'Test it this way. Suppose a material fell squarely within one of the definitions of the schedule, and 10 years after the Act, 20 if you like, is passed, there is a substantial production at home and relatively small importation, do those factors in any way conflict with the necessary conclusion that the material in question is within the ambit of the section?'

Mr. Graham: 'No, of course they do not. If the position is that you come to the conclusion that you are driven to include a particular thing in an Act . . . you must presume that Parliament did intend that.'

Import/Export Figures

Referee: 'How do the relative figures of importation and exportation come in?'

Mr. Graham: 'They come in this way, that if you are in doubt about the matter you are entitled to consider what sort of an industry this Act was intended to protect; and in my submission quite clearly it was intended to protect an industry such as the fine chemical industry in its infancy which really needed protection. Therefore, if, as I suggest is the case here, the real point is whether there was ever any intention whatever of covering the plastics industry as an industry, then it does become very material.'

Referee: 'If there is no doubt that the plastics industry was not intended to be covered, that would be an additional reason for disregarding the figures of the plastics industry.'

The referee, said Mr. Graham, in dealing with section 1(5) of the 1921 Act would have to consider when there was a dispute as to whether a particular article about which there was argument fell within the general description. The referee suggested the point arose with reference to the B.o.T. including paraformaldehyde and certain other substances on the list.

Mr. Graham said that as a matter of law what was on the list, or what had been taken off the list, was irrelevant to the question that the referee had to decide.

The 1921 Act showed an intention to

protect the plastics industry and the sort of products it was producing, stated Mr. Graham. The opponents strongly contended that the Act had no such intention at all, but if that was right, the real question was whether the Act, which was a taxing Act, applied to the plastics industry and its products at all, and it was perfectly right to say that the ordinary rule applied.

One of the most striking things in the section itself was that there was not any mention of the plastics industry, nor were there any words used which directly applied to its products. If the Act really had intended that the plastics industry should have been protected, it would have been easy to put at the foot of the section, such words as 'and materials manufactured by condensation or polymerisation processes'. If these words had been included, quite clearly polymers and mixtures of this type would have been included. The wording of the Act showed a clear intention to protect only what might be called chemical raw materials. It was a raw material Act.

Sir Lionel had endeavoured to get Dr. W. G. Barb, chief technologist, Plastics Group, Metal Box Co., to agree that polythene was a raw material. Sir Lionel then said that Sir Christopher Ingold had agreed that it was. Dr. Barb's evidence on polythene granules was then quoted. Dr. Barb had said, in reply to Sir Lionel, that he would be a little surprised to hear polythene described as a raw material, because it could, by a process of mere physical shaping, be converted into the finished article.

'Not a Raw Material'

Dr. Barb did not accept that polythene was imported as a raw material but that it was imported to make manufactured goods.'

Sir Lionel had asked, said Mr. Graham: 'Do you tell the tribunal that your understanding is that a material which is imported for the sole purpose of incorporation and fabrication is not a raw material . . . ?' In reply, Dr. Barb had said: 'I would wish it to be recorded that my understanding of the phrase "raw material" implies that a greater change has to take place between the raw material and the finished article than is the case with this, in the conventional use of the phrase "raw material"'.

Discussing the last section of the actual Schedule, Mr. Graham said that in his submission the position was, that all synthetic organic chemicals and analytical reagents were in fact fine chemicals. The expression 'fine chemicals' also included some special things such as colchicine and vitamins. Reading that section and comparing it with the rest of the schedule and the way that schedule had been drafted, the intention was to emphasise that the synthetic organic chemicals were the fine chemicals, and therefore when it came to fine chemicals—'and other fine chemicals,' thereby suggesting that it was clearly intended to cover only those synthetic organic chemicals which were fine.

His construction, maintained Mr. Graham, gave meaning to every word of the section. It was consistent with the intention to safeguard that industry which needed safeguarding, namely, the fine chemical industry, and was consistent with the rest of the schedule itself. The complainants' reading, which was to read the various sections disjunctively, strained the language because it gave no meaning to the word 'other' when 'analytical reagents' was not coupled to the 'fine chemicals' phrase by the word 'and.'

A second point made by Mr. Graham was there was a further limitation on the

Professor C. E. H. Bawn, witness for the complainants, whose evidence was reported in C.A., 15 and 22 November

section. The argument was that the phrase 'synthetic organic chemicals' was limited to substances or bodies which could be accurately identified and accurately specified as having a particular formula, the argument being that unless the words were limited, such things as soap, nylon, Terylene, phenol, petrol, rubber, etc., could be covered.

The referee pointed out that the argument went further than that. The argument was that that was the technical meaning of this phrase.

On the evidence there was no argument and witnesses had agreed that the polymers could not properly be described as 'synthetic organic chemicals.' The referee said he thought that there was an enormous body of technical evidence that was directed to that point. The complainants contended that the polymers did fall within that definition.

Basis of the complainants' case as expressed by Sir Lionel was that the expression should be interpreted by looking first at the word 'chemical' and getting its ordinary meaning, then turning to the two adjectives and seeing in what respect the ordinary meaning was limited by the adjectival restrictions.

An attempt had been made to meet what Mr. Graham considered a fatal objection on the facts of the argument (that polymers had no precise known structure nor had the formula of any of them been specified). Dr. Williams had sought to maintain that analysis of any polythene would lead to a CH ratio which was unique to polythene. The ratio was not unique; it was equally true of many other substances, cyclopropane, cyclohexane and similar compounds.

Then Professor Bawn and Dr. Williams had said the polymers were a mixture of chemical compounds, but that this mixture was inseparable. There had not been any attempt by the complainants to prove the contention of Dr. Williams and Professor Bawn. There was no positive experimental evidence, or anything of that sort, produced to prove that what they said was right.

Sir Christopher Ingold had indicated in evidence that it was quite impossible to regard the various fractions obtained as constituting the same chemical, because they had different chemical reactions and therefore they could not be regarded as a 'synthetic organic chemical' within the proper meaning of that phrase.

The complainants, Mr. Graham said, could not meet that argument, because if the phrase was construed as it should be construed the polymers in question just did not fall within it—they just could not be described as ascertained compounds having a specific formula. The only thing the complainants had attempted to do by way of giving them a formula was to give them a generic formula, which was merely a generalised formula, the nearest thing that could be got to in the circumstances.

Finally they had said that the term 'synthetic organic chemical' was not a technical but a loose industrial term. Mr. Graham considered it quite unthinkable that Parliament could have intended in a precise taxing statute, as this was, such a meaning to be given to this phrase, because it would cover petrol, soap, even gaseous effluents. It would cover many other materials, which by no stretch of the imagination could sensibly be called chemicals.

There was the really substantially unchallenged and certainly unshaken evidence of Sir Christopher Ingold that the proper meaning of the phrase 'synthetic organic chemical' in 1921 was as he defined it. The complainants had not given evidence on the basis of what the phrase meant in 1921.

The last point to be made by Mr. Graham was what he chose to call the 'mixture argument,' which was that there was no reason why polythene should not be put on the list, defining it as covering each and every macromolecule of ethylene, polymerised macromolecule of ethylene. The complainants said that polymers were a mixture of particular macromolecules which could properly be called chemical compounds because, theoretically at any rate, they could be separated and theoretically eventually could be found an exact formula. The argument was based on the evidence as to the cumene, phenol acetone reaction (Sir Christopher's evidence during Sir Lionel's examination).

Individual polymers had never been made as a matter of commerce said Mr. Graham. They could not, certainly, at the present time, be made; and so far as in the case was concerned, nobody would ever want to make them. That was the real position they could not now, and they probably never would be, accurately specified. The value of the polymers in question lay in the very fact that they were mixtures.

Tribunal finds that the Polymers were properly excluded from the K.I.D. list. The effect of the award is that the duty chargeable on these materials when imported from foreign sources remains unchanged at 10%.

U.K. CHEMICALS OUTPUT TOPPED £2,000 M. MARK IN 1957

GROSS output of the U.K. chemicals and allied trades during 1957 for the first time topped the £2,000 million mark, according to the preliminary results of the 1957 census of production. Net output was £657.1 million. Gross output of general chemicals during 1957 was £418.5 million, compared with £399.3 million in 1956; net output of general chemicals totalled £171.6 million last year, compared with £160.1 million in the previous year.

The Board of Trade's index of industrial production, based on a 1954 average of 100, showed for June this year an index for 'chemicals and allied industries' of 115, the same as the second quarter 1958 average and the same as was recorded for 1957.

The following statistics are taken from the provisional results of the 1957 census and cover all U.K. manufacturing establishments:

		Gross Output £m.	Net Output £m.	Total Employed (Thous.)	Wages and Salaries: Operatives Wages £m.	Wages and Salaries: Other Employees £m.	Capital Expenditure: Plant Machinery and Vehicles Acquired £m.	Capital Expenditure: New Building Work £m.
Chemicals and allied trades	1954	1,687.2	528.5	400.6	125.2	80.5	79.1	20.4
	1955	1,836.6	573.4	407.6	137.7	88.6	81.0	24.5
	1956	1,966.8	614.6	416.5	150.4	98.8	115.5	33.4
	1957	2,102.9	657.1	416.7	158.8	104.9	136.3	34.0
of which:								
Chemicals (general)	1954	333.0	133.6	91.0	32.5	19.4	29.3	5.7
	1955	367.9	148.0	92.8	36.3	21.7	31.7	7.1
	1956	399.3	160.1	97.1	39.9	24.3	42.6	9.2
	1947	418.5	171.6	95.9	41.4	25.9	51.4	9.7
Drugs, etc.	1954	120.5	62.6	49.5	11.1	9.7	2.8	1.2
	1955	134.1	66.3	51.8	12.3	11.4	4.5	2.5
	1956	139.5	74.4	51.2	13.1	11.8	5.0	3.9
	1957	150.4	80.6	52.4	14.2	13.1	4.6	3.5
Paint & varnish ...	1954	113.1	45.7	38.2	8.4	10.7	2.4	1.1
	1955	124.0	50.0	39.6	9.4	11.8	3.5	1.6
	1956	128.1	52.0	40.7	10.0	12.5	3.6	1.8
	1957	139.4	54.3	41.4	10.8	13.2	3.7	2.4
Soap, candles & glycerine	1954	94.1	28.7	22.1	6.1	4.5	2.9	0.5
	1955	93.4	27.0	20.4	6.0	4.6	1.8	0.8
	1956	106.0	33.0	21.3	7.1	5.6	2.3	0.7
	1957	115.1	35.7	22.1	7.5	6.1	3.2	0.6
Mineral oil refining ...	1954	304.6	37.0	16.4	6.6	2.6	13.2	2.8
	1955	321.4	47.3	16.7	7.4	3.0	10.8	2.3
	1956	346.1	49.6	18.3	8.7	3.8	17.7	4.3
	1957	384.1	43.0	18.8	9.3	4.3	34.6	7.5
Plastics materials ...	1954	83.1	32.6	22.1	7.5	5.5	4.9	1.5
	1955	99.1	36.3	24.4	8.9	6.3	6.7	2.4
	1956	104.2	35.5	25.0	9.5	7.3	12.2	3.4
	1957	120.4	40.3	26.4	10.5	8.1	9.4	2.8

Despite Mounting Costs, Glaxo Products Sell at About Half of 1948 Prices

CRITICS who singled out the selling and pricing policies of the pharmaceutical companies for attack failed to understand their problems and accomplishments, declared Sir Harry Jephcott, chairman of Glaxo Laboratories Ltd., in his annual statement to shareholders. During the past 10 years, wages for U.K. employees had risen by well over 50%; prices paid for raw materials had risen by over 25%. In the same period, however, not one of the company's pharmaceutical or antibiotic preparations had been increased in price. In fact, declared Sir Harry, a customer purchasing a representative group of those products would pay little more than one-half the price he would have paid 10 years ago.

Sales by the parent company and subsidiaries (excluding Allen and Hanburys) rose by 15% in 1957-58. Much of the greater part of the increase occurred in the first half of the year when group turnover rose 24 per cent over the same period of 1956-57. The average margin of profit was slightly less than 10 years ago.

Sir Harry spoke of the increased profitability disclosed in the Allen and Hanburys accounts. The turnover and profitability of the Murphy Chemical Co., both at home and overseas, had increased. Since the end of the financial year, Glaxo had acquired the merchandising business of R. E. Harding and Co. Ltd., who for many years had been their West African agents.

The rate of expansion of turnover, which began during 1955-56 and continued into the first half of this year, could not be expected to last indefinitely. It was the result of certain major capital projects at home and overseas during a period of exceptionally favourable trading conditions. Throughout the world those conditions were now passing; in many markets they had already come to an end.

Shortages of foreign currency in primary producing countries led those nations to set up their own production facilities. Glaxo had steadily built up their own manufacturing units in those countries and during 1957-58 they had opened factories in Ceylon and Columbia, making a total of 12 such companies. Further additions were planned.

Prince Philip Opens New Ferodo Research Centre

THE NEW Ferodo research laboratories at Chapel-en-le-Frith, Derbyshire, were opened by Prince Philip on 21 November. The new three-storey building, built at a cost of £750,000, brings under one roof chemical and physics laboratories, test houses, etc.

Research and development on friction materials for which the new centre will be responsible will benefit the motor industry, railways, aviation, mining and many other industries. Fundamental research will be carried out on surface friction, the structure of asbestos, of which white or chrysolite asbestos is the most important variety and which corresponds approximately to $Mg_3Si_2O_5(OH)_4$; chemistry of the resins needed to bond the constituents of a brake lining; the evolution of linings, usually the joint concern of chemist and physicist; powder metallurgy techniques for friction materials; development of cerametallics for friction materials.

Extension to Windscale Chemical Plant Planned

MAJOR extensions to the chemical plant at Windscale will be required, states the UK Atomic Energy Authority, following the recent decision that the plant at Windscale will process plutonium from C.E.G.B. power stations, as well as from the A.E.A's own stations at Calder Hall and Chapelcross.

The primary separation plant has already been reconstructed so as to increase its throughput capacity fourfold. A new cooling pond is to be built. In addition, work has started on an advanced gas-cooled reactor to be completed by 1961.

Four New Silicone Resins Introduced by I.C.I.

FOUR new silicone resins have been added to the range produced by the I.C.I. Nobel Division—DP 89, DP 103, DP 87 and DP 88. These materials are said to provide full silicone protection to the organic component of surface coatings exposed to heat. Success has attended the cold-blending of a silicone and an organic resin, but to secure the fullest heat resistance and protection, heat-blending or copolymerising is advisable.

Resin DP 89, a baking-type silicone epoxy co-polymer, possesses excellent adhesion, chemical and solvent resistance and thermal stability. Resin DP 103, a baking-type silicone-organic co-polymer designed for the formulation of heat resistant paints, will withstand temperatures up to 250°C. Resins DP 87 and 88 are new types of silicone intermediates which may be heat-blended with many different organic resins to prepare silicone organic co-polymers. One of their main applications is in the production of heat-resistant silicone-organic resins having good hardness, flexibility, adhesion, solvent resistance, gloss and colour retention at temperatures up to 250°C.

INTERNATIONAL PLASTICS CONFERENCE

New Developments in Plastics Materials Reported

H. Verity Smith, Consultant, reports on the Swedish Plastics Federation Conference

PLASTTEKNIK 1958', the eleventh of the Swedish Plastics Federation International Conferences which closed in Stockholm recently, attracted an attendance of about 500 including 175 foreign delegates from 11 countries, including 27 from U.K. firms.

The conference opened with a paper by Dr. V. E. Yarsley, read in his absence by Mr. W. Flavell, who surveyed the development and future of the industry with confidence and quoted a recent forecast of a 2 million ton annual production of plastics in the U.K. by 1984.

Vinyl Compounding Materials: Dr. H. H. von Reuss of Deutsche Advance Produktion G.m.b.H., Marienberg, gave a paper on methods of testing vinyl heat stabilisers, followed by Mr. H. Verity Smith, Meister AG., Basle, who reviewed the different types of organotin stabilisers before outlining the new Meister stabiliser system, which was described here for the first time. The Meister system abandons the conception of proprietary stabilisers, and by means of a series of mutually miscible bases prepares individual one-package stabilisers for each specific vinyl polymer and application. Considerable technical and economic advantages are claimed for this method. In a second paper Mr. Verity Smith discussed the technical, psychological and commercial problems involved in vinyl technical service.

High Mol. Wt. Plasticisers

Mr. Alan Hill, Geigy (Manchester), in an excellent survey of the high molecular weight plasticiser field, gave a clear picture of the different properties of the various groups of materials generally (and improperly) lumped together under the misleading term 'polymeric'. More general circulation of Mr. Hill's paper might remove a number of misconceptions common in the minds of vinyl compounders.

A paper on 'Plasticisers from higher oxo alcohols' by W. L. Dunkel and W. A. Dimmler of Esso Research and Engineering Co. (Linden, NJ) was read by Dr. K. L. Beach of the company's London office. The oxo process, discovered by Roelen of Ruhrchemie in 1933 consists of reacting an olefin with carbon monoxide and hydrogen in the presence of a soluble cobalt carbonyl catalyst at 200 atmospheres and temperatures between 100° and 180°C. This yields a saturated aldehyde with one more carbon atom than the original olefin. The aldehyde is the hydrogenated to the alcohol. It was interesting to learn that 90 per cent of the higher oxo-process alcohols produced in the U.S. are used for plasticisers manufacture. The paper was primarily devoted to the esters of the oxo octyl and decyl alcohols, the former being largely composed of three isomeric dimethyl hexanols and the latter of three isomeric trimethyl heptanols.

Didecyl phthalate, based on oxo decyl alcohol, is now of major importance in the U.S. as a primary vinyl plasticiser. Esterification of oxo decyl alcohol with phthalic anhydride gives an ester of lighter colour than is obtained from 2-ethyl hexanol or oxo iso-octanol. This improvement is so marked that 'carbon blacking' can be dispensed with and still provides a plasticiser of acceptable colour.

Most of the improved properties claimed for DDP depend upon its lower volatility as compared with DOP, and hence its superior retention by the plasticised vinyl compound in service. For example, although the initial Clash and Berg low temperature flexibility is inferior in a DDP-plasticised compound to that obtained with DOP as a plasticiser; after seven days at 100°C., DDP gives the better result, a matter of considerable significance to compounders faced with some of the newer cable specifications, particularly as DDP also confers superior volume resistivity on the compound.

Mr. G. P. Herz, Rohm and Haas (Philadelphia) in his paper on 'Plastiziser permanence in flexible p.v.c. systems', mentioned the figure of 400 different commercial plasticisers on sale in the U.S. at present. He based his paper on the proposition:

$$\text{Plasticiser permanence} = \frac{\text{Affinity for plasticised resin}}{\text{Affinity for contacting media} \times \text{mobility}}$$

He dealt with the relationship between volatility and permanence, the resistance of plasticisers to laundering, to extraction by fats and oils, and to migration into rubber and cellulose lacquers. The paper was supported by a wealth of data on the Rohn and Haas plasticisers, carefully selected for the relationship of the test results to actual conditions likely to be encountered by vinyl articles in service.

Great interest was aroused by two papers on the new developments in 'The lamination of vinyl plastics to other base materials' given by Mr. W. E. Martin, B.X. Plastics Ltd., and Mr. F. Smith of John Summers and Sons Ltd., the two U.K. firms which have co-operated to make large advances in this field. The great technical difficulties which had to be overcome in the preparation of the laminates were lucidly explained by Mr. Martin, and contrasted with the relative cheapness of the product. Mr. Smith stressed the versatile utility of a steel requiring no painting and having, in effect, a 'built-in' decorative effect. He described the wide range of conventional and special sheet-metal fabrication techniques which can successfully be applied to these laminates, which clearly have a tremendous future. The advantages of a steel sheet supplied with an acid-, alkali- or oil-resistant surface from which can be fabricated items of chemical plant without the use of special fabrication techniques must be apparent to all plant manufacturers.

Polyolefin Developments

Polyolefins: The intense activity in this field was reflected in papers by Dr. J. M. Goppel, of NV de Bataafsche Petroleum Mij. (The Hague) and Dr. W. P. Moeller of Amcel Co. (USA).

Dr. Goppel reviewed the chemistry of the Ziegler-Natta polymerisation systems with emphasis on the relationship between structure and physical properties of the Ziegler and Phillips types of polythene, iso- and atactic polypropylene and the mixtures of iso- and atactic polypropylene resulting from the use of the Ziegler ($AlEt_3$ + $TiCl_3$) catalyst systems. Dr. Goppel commented on the difficulty of finding as adequate stabiliser system for polypropylene. (It is probable that this is one of the major reasons for the apparent delay in the commercial availability of this long-heralded polymer).

Dr. Moeller's paper was concerned with the processing and fabrication of a new type of polyolefin co-polymer, of undisclosed composition, made with a new catalyst system, called Fortiflex B. This appears to be the beginning of an attempt to tailor-make olefin co-polymers for specific applications, and involves a variety of technical problems, particularly in the handling of monomer and catalyst feeds. Outstanding characteristics of these special co-polymers in the required directions, however, would appear to justify the very considerable research and development costs involved.

Dr. A. K. van der Vegt, Central Laboratories of TNO (Delft) discussed the testing of the Shell Ziegler-type polythene 'Carlona 500', with particular reference to the expected service life of pipes made from this material, subjected

to specified working stresses in the presence of various agents which could be expected to accelerate failure by stress-cracking. A theoretical model has been established to explain the effect of, for example, detergents, on failure by brittle fracture.

Polyesters: Mr. Brian Parkyn, Scott Bader Ltd., in a paper on 'Self-extinguishing polyester resins' discussed the use, manufacture and testing of these interesting materials. He listed six methods of reducing the burning rate of the resins:

1. Addition of inorganic fillers (such as antimony oxide).
2. Addition of organic fire-retardants (such as chlorinated waxes and chlorinated diphenyls).

(In practice 1 and 2 are used together and give a greater effect than either used alone.)

3. Chemical modification of the saturated acid in the resin, e.g. replacement of phthalic anhydride by tetrachlorophthalic anhydride or by hexachloroendomethylene tetrahydrophthalic acid (HET acid).
4. Chemical modification of the unsaturated acid in the resin, e.g. by using chlormaleic acid.
5. Chemical modification of the monomer, e.g. replacing styrene by diallyl benzene phosphonate.
6. Combination of organometallic compounds with the resin, e.g. antimony alloxide, which will react with HET acid polyesters.

The manufacture, properties and applications of polyethylene terephthalate films were summarised by Mr. W. H. Birtles, ICI Plastics Division (Welwyn) particularly noting their outstanding mechanical strength over a wide range of temperatures, their excellent electrical properties and their low permeability to water vapour and gases. Mr. Birtles suggested that the versatility of these films was such that there is hardly an industry in which they will not find an application.

New Materials: Three new materials were discussed, two of which, the polycarbonates and 'Delrin' have attracted a great deal of attention.

New Hydrocarbon Thermosetting Resin

Less widely publicised has been "A new hydrocarbon thermosetting resin for reinforced plastics' known (one hopes provisionally) as MDE 1, which was described by Dr. B. M. Vanderbilt and Dr. H. Clark, Esso, in a paper read by Mr. J. L. Betts. This is a liquid 80/20 butadiene/styrene copolymer synthesised in such a way that the butadiene tends to react as a mono-olefin, enabling the polymer to be cross-linked. Low-density, low-water absorption and excellent electrical properties are claimed. At present in the pilot plant stage, the resin is expected to be highly competitive with other materials used for the manufacture of reinforced laminates.

Dr. G. Peilstocker, Farbenfabriken Bayer (Uerdingen), read two papers by himself and Dr. W. Hechelhammer (who will give a paper on the same subject at the SCI Plastics and Polymer Group meeting in London on 6 January) on the new German polycarbonate resin 'Makrolon'. Summaries of these papers were not available at the conference.

The new du Pont polymer based on formaldehyde, 'Delrin', was described by Dr. R. A. Osten. Commercial quantities of this polymer are expected by the summer of 1959 from a plant now under construction. Because of its high abrasion resistance, low coefficient of friction, high fatigue endurance limit under repeated impact and minimal deformation under load, this highly crystalline material is expected to prove useful for the manufacture of machine parts such as gears, cams and bearings. Delrin can be moulded on conventional injection moulding machines, and, because of its low water absorption, its dimensional stability is excellent.

The next International conference of the Swedish Plastics Federation will be held in the late autumn of 1960.

Surface Tension Reducing Power of Some Surfactant Substances

By
M. A. Phillips,
D.Sc., F.R.I.C.

THE identity and chemical character of some of the commoner surface-active materials are frequently hidden behind proprietary names and it is often difficult to find, without actual determination, the order of the surface-active reduction to be expected using solutions of various concentrations of these materials. This can be a handicap to formulators using these surfactants for insecticide compositions, wetting agents, cosmetic preparations, detergents etc.

While it still remains true that the actual surface activity of any particular preparation can only be found by actual determination, since the activity is considerably influenced by the presence of other materials, particularly inorganic salts, it is often desirable to know the actual figures for surface tension of particular concentrations of the pure or practically pure material, at least for purposes of comparison and of comparative cost per unit of activity.

Noted below, therefore, are some figures, in the form of a curve, for some well-known surfectants, all for the 100% basis:

A Polyethylene oxides (Pogols, Carbowaxes)—non-ionic

$CH_2OH\ CH_2(OCH_2CH_2)_n\ OCH_2CH_2OH$

B Sodium lauryl sulphate (Lorol)—anionic

$R\ O : SO_3Na$

C Sodium dodecylbenzene sulphonate (Nansa)—anionic

$G_{12}H_{15}.C_6H_4.SO_3Na$

D Sodium di-octyl sulphosuccinate (Manoxol OT, Aerosol, Alcopol)—anionic

$$Na\ O_3\ S.CH\ COO\ C_8H_{17}$$
$$|$$
$$CH_2COO\ C_8H_{17}$$

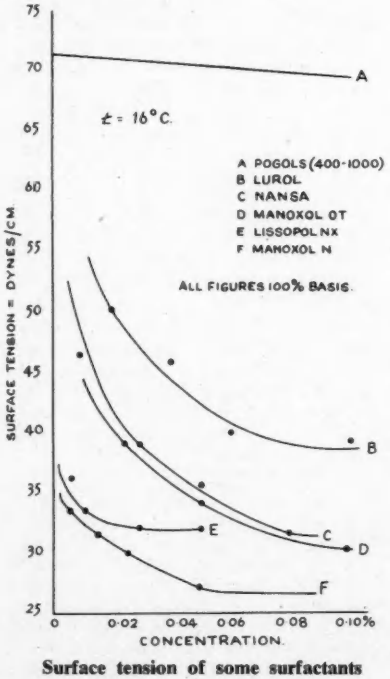
E Octyl-cresol condensation product with polyethylene oxide (Lissopol NX)—non-ionic

$$C_6H_3\begin{cases} CH_3 \\ C_8H_{17} \\ OCH_2CH_2(OCH_2CH_2)_n\ OCH_2CH_2OH \end{cases}$$

F Sodium di-nonyl sulphosuccinate—anionic

$$NaO_3S.CH\ COO\ C_9H_{19}$$
$$|$$
$$CH_2COO\ C_9H_{19}$$

G Cetyl pyridium chloride—cationic



Surface tension of some surfactants

It will be seen that the polyethylene oxides are only feebly surface active and that the sodium alkyl sulphosuccinates are highly surface active with octylphenol condensation product with polyethylene oxide also of high activity. However, surface activity is not the only criterion of utility in compositions which require to have spreading power or detergency etc., and such other properties as solubility in oils, organic solvents, water etc. whether a waxy solid, a free-flowing solid etc., have also to be taken into consideration, as well as the compatibility of the final formulation with other materials.

All the curves are asymptotic and the asymptote of the concentration axis reveals the critical nuclear concentration for the temperature at which the measurements were made.

AUTUMN GAS RESEARCH MEETING

WORK ON OXIDE PURIFIERS LEADS TO GREATER EFFICIENCIES

PAPERS presented at the 24th Autumn Research Meeting of the Institution of Gas Engnieers at Church House, Westminster, S.W.1, on 18 and 19 November, likely to be of interest to readers of CHEMICAL AGE include the following: 'Removal of hydrogen sulphide from gas using an organic oxygen carrier,' by J. E. Davis, J. E. Mills and C. Ryder; 'Liquid reagents for the final removal of hydrogen sulphide from gases' by W. B. S. Newling; 'Hydrogenation of light distillate with reference to the production of by-product aromatic hydrocarbons,' by L. A. Moignard and K. D. Stewart; 'An investigation into the composition of ammoniacal liquor. Part II—A survey of effluents produced in the gas and coking industries,' by L. Barker and N. W. Hollingworth; 'Chromatographic gas analysis,' by G. R. Boreham and F. A. Markoff; 'Measurement of gas stream temperatures in industrial appliances. II—A suction pyrometer for temperatures above 1,100°C,' by P. G. Atkinson and J. R. Hargreaves; 'Influence of frequency of rotation on the behaviour of oxide purifiers,' by J. M. Brown, S. C. Porter and R. J. S. Thompson.

Influence of Rotation Frequency

Work being carried out on the influence of frequency of rotation on the behaviour of oxide purifiers was reported in the paper by Brown *et al.* and the theoretical considerations prompting the work were discussed.

Removal of hydrogen sulphide from coal gas using iron oxide is widely adopted and advances in oxide purification have been mainly limited to considerations of the quality of the oxide used, but frequency of rotation of the containers has also been studied. During an attempt to follow the reactions to heat developments and the loss of moisture in the purifiers, one of the authors made two important discoveries: (1) The efficiency of a purifier in the first-taker position immediately after rotation was invariably high even if the charge was nearing the end of its life. It was usually in excess of 90% removal of hydrogen sulphide and was seldom below 80% even in the worst cases; (2) In every instance, even with new charges, efficiency began to fall away after 24 hours.

These observations led to the idea that rotations more frequent than every 24 hours might be beneficial and an experimental apparatus was set up comprising four towers. The first series of experiments was conducted on half-hour rotation and it was soon evident that sulphiding of the oxide was progressing at a steady rate up the towers but at all times the outlet gas from the third and fourth towers was clean.

Comparisons were then made between 24-hour and half-hour rotations and there were marked differences in the spent oxide discharged. First-taker air admission, 24-hour rotation, resulted in a very hard dry oxide which was very difficult to remove from the towers while the same arrangement on half-hour rotation gave an oxide that was friable and moderately hard but which could be removed easily. In the arrangement second-taker air admission, half-hour rotation, a tower was emptied before it was fully spent and its condition examined. It was much more uniform in structure than the two above and was easily removed.

Results Encourage Large-scale Work

From these expermients it appeared that frequent rotation had several advantages, one in particular being that if the first-taker efficiency were kept high, the time available for revivification would be increased. While the experiments were being completed, the results were considered sufficiently encouraging to apply the technique to a large-scale operation.

Nechells Works, Birmingham, was chosen as the site for full-scale application. Here, the tower purifier installation had 12 working towers, each with 14 containers carrying two trays of purifying material 17 in. deep. The plant was designed to purify 24 million cu. ft. of coal gas per day and the hydrogen sulphide content was assumed to be 550-650 grains per 100 cu. ft.

Operational difficulties were associated with the high hydrogen sulphide content, the drying out of the oxide and the apparent inability of tower purifiers to dissipate the heat evolved. To overcome these, use of 100% new oxide in the towers had been discontinued and the hydrogen sulphide content of the gas at the inlet had been kept at 600 ±50 grains per 100 cu. ft. by careful selection of coals for carbonising, but results were still unsatisfactory. Spent oxide withdrawn from the system showed a consistently low moisture content and sulphur contents rarely exceeded 48%. There was ample evidence that drying out of the oxide continued above that normally experienced with box purifiers, and the recharging schedule was operated to give a working life of a charge in the gas stream of approximately 140 days at an average load factor of 80%.

Including initial and final testing for hydrogen sulphide, the average time taken was 1½ hours for the rotation of two sets of tower purifiers. Only one U-valve was operated at any one time and fifth and sixth takers had to be tested before and after the operation. An undue amount of the supervising foremen's time was absorbed by the 4-hour rotation and other shift foremen had to be trained and authorised for the responsible duty of manual valve operation.

Mechanisation of valve operation is under active consideration to facilitate the present system and this would enable studies of more frequent rotation to be undertaken.

Increased frequency of rotation had many advantages. It had no significant effect on the efficiency/time relationship and thus more frequent rotation should give higher average first-taker efficiency. Temperature distribution and moisture retention were considerably improved as is shown in Table I.

TABLE I.

	Before July 1957	After July 1957
No. of towers	2	3
Moisture %:		
Mean	5.7	7.7
Standard deviation ...	0.9	1.2
Sulphur, wet basis %:		
Mean	44.4	47.1
Standard deviation ...	1.3	1.4
Sulphur, dry basis, %		
Mean	47.1	50.9
Standard deviation ...	1.3	1.4

Difficulty of efficient hydrogen sulphide removal (in excess of 550 gr. per 100 cu. ft.) was one of the problems associated with the plant before these tests were undertaken and a zinc acetate washer had to be used to remove final traces. Sulphur loading, even in excess of designed capacity, can now be dealt with while at least two purifiers out of a set of six can be maintained clean.

Production of saleable oxide had proved difficult, with the accumulation of part-spent oxide at the works but this had now been absorbed and no surplus was available.

It had been the practice to admit 5% air for revivification but this had now been reduced to 3 to 3½% by the system of frequent rotation, and the margin of safety of the purification process had increased.

Further investigations are planned to study second-taker air admission, because recent work has indicated that such a system is most effective with frequent rotation.

Motor-tanker Fitted with Hughes Anti-corrosion System

Italy's largest and fastest motor tanker, the Sicilmotor, is protected against corrosion in cargo/ballast compartments by the Guardion multi-fin system of cathodic protection of F. A. Hughes Ltd., 4 Stanhope Gate, London W.1. More than 130 vessels have received protection with this system.

Gas Research Meeting

Organic Oxygen Carrier Removes Hydrogen Sulphide From Gas

WITH developments in the production of gas under pressures of several atmospheres, interest has been revived in processes for the removal of H_2S from these gases by liquid reagents. Features to be desired in such processes were discussed by J. E. Davis, J. E. Mills and C. Ryder of the South Eastern Gas Board. Most of the features are shown to be obtained by employing a washing medium in which an organic dyestuff, methylene blue, acts as an oxygen carrier. The work reported by Davis *et al.* has been aimed at the development of a process of practical value. Following experience with a small pilot plant, a plant to purify 10,000 cu. ft. of gas/hr. is now being constructed.

Liquid purification processes have been examined recently since the iron oxide process cannot operate under high pressures to deal with high concentrations of H_2S. Most of the proposals which have been advanced for the removal of H_2S from fuel gases under pressure have depended upon preferential solution of the acid gases, aided possibly by the chemical affinity of these gases for a basic substance contained in the solvent. Where the gas contains a high proportion of CO_2, particularly if substantial quantities of steam are used either for gasification itself or for subsequent shift conversion of carbon monoxide, complete removal of H_2S becomes impracticable and separation of H_2S from CO_2 poses a new problem.

Removal of Acid Gases

These then were the considerations which led to search being made for a process whereby the two acid gases could be removed separately and independently. Oxidation of H_2S to elemental sulphide was a favoured possibility. In 1921 the use of certain organic dyestuffs had been proposed as oxygen carriers for the specific purpose of oxidising hydrogen sulphide and removing it from fuel gases (Evans and Stanier, Brit. Pat. No. 168,504). However, since at that time operation was at near atmospheric pressure, the idea was not developed practically. Davis *et al.* reported their results of re-examining this idea.

Features desirable in a purification process: Of major importance in all wet purification processes is avoidance of the handling of solid materials. Ability to remove H_2S completely is another. (In practice it has not proved possible to remove H_2S completely because of the finite partial pressure of the gas in the washing solution after regeneration to the greatest extent, economically practicable. Also the influence of CO_2 in the gas is a major complicating factor). In completion of purification it is necessary that the sulphur should be recovered in a marketable form, elemental sulphur being the most attractive. A distinct advantage is recovery of elemental sulphur direct without the need of a Claus kiln. Regeneration of the absorbent solution with the minimum use of steam or power is another advantage. Finally, the avoidance of noxious effluents either liquid or gaseous, which are likely to arise through operation of undesirable side reactions.

Organic dyestuffs as oxygen carriers: It had been shown by Evans and Stanier (reference above) that there were a few classes of organic dyestuffs in which the balance between ease of reduction and the ease of oxidation permitted each reaction to proceed as a useful speed. A particularly useful dyestuff was methylene blue.

The desirable higher speed of reaction has been obtained using the methylene blue base derived from the chloride.

Use of Methylene Blue

Methylene blue, in its oxidised form, is a very strong base and the chloride ion cannot be removed. In the reduced form of the leuco compound, chloride ion is readily removed by an alkali in aqueous solution. On oxidation of the leuco compound, the methylene blue base or more probably its hydroxide or carbonate, state Davis *et al.*, remains in solution ready to react with H_2S. This means that not only the active methylene base can be employed for oxidation of H_2S, but also that if some portion of this base becomes fixed by acid radicals, such as sulphur oxy-acids, these acid radicals can be removed and the base regenerated by very simple treatment.

If the solvent chosen for methylene blue has a limited solvent power for water, an aqueous layer separates from the solution of reduced dyestuff. If this aqueous layer is then made alkaline with ammonia, acid radicals attached to the leuco compound are removed as ammonium salts.

One of the tasks undertaken in the recent work has been the review of a wide range of possible solvents in order to select one which most closely fulfilled the requirements of the process. Eliminated were: those with melting-points at or above room temperature; those with boiling points below 180°C; those which were miscible or very soluble in water; those with unsaturated linkages, such as olefines, a tendency to hydrolysis such as esters, or a tendency to oxidation, such as sulphides and disulphides; and the chlor-compounds.

Table I indicates the good solvents which were found among those compounds possessing a primary amine group, a hydroxy group, or *hetero*cyclic nitrogen. The next step was to select substances from these groups bearing in mind their availability and price and their compliance with the other requirements, in order to measure the rate of reaction with H_2S of the methylene blue base dissolved in such substances. Aniline was selected finally as a suitable solvent.

TABLE I

Methylene Blue Base Solubilities

Solvent	Methylene Blue Oxidised form (%)	Base Solubility Leuco form (%)
1	2	3
Aniline	18	7
O-Chloroaniline	20	10 to 20
O-Tolnidine	10	6
O-Anisidine	8	3
Ethyl naphthylamine ...	3	6.5
Cresylic acid	27	20
O-Chlorophenol	37	<37
1:3 Xylen 2ol	24	<24
Pyrrole	27	>27
Collidine	8	19
Quinoline	7	15
Benzyl alcohol	20	19.5
O-Hydroxyacetophenone	6	10

The solution now being used for the operation of the process contains four parts by weight of methylene blue dyestuff dissolved in 100 parts of solution. Only two of properties considered as desirable are stated to be lacking. The solution is corrosive towards mild steel so that vessels, pipelines and pumps handling the solution must be in stainless steel. The second undesirable characteristic is the toxicity of aniline both as liquid and as vapour. This can be eliminated by appropriate safety measures.

Several side reactions have been found to take place to some extent and steps have been taken to bring them under a measure of control.

Formation of sulphur oxy-acids: In attempting to oxidise H_2S to elemental sulphur a proportion invariably appears as sulphur oxy-acids (thionates, thiosulphate, sulphite or sulphate). Davis *et al.* report that it has proved possible so to operate the methylene blue process as to keep the formation of sulphur oxy-acids to a low figure and then to introduce a simple operation for removing the small quantity that is formed. Sulphur oxy-acids have been found to form most readily if unoxidised H_2S is allowed to remain in solution in the washing medium as it leaves the absorber, or if free oxygen remains in solution when the washing liquid returns to the absorber. The plant is therefore operated so that the washing liquid leaves the absorber with a substantial proportion of the methylene blue still unreduced and leaves the oxidiser for return to the absorber with a substantial proportion of the leuco compound still not re-oxidised.. The loss of sulphur as sulphur oxy-acids is stated to be kept well below 3% of the total sulphur removed. By applying the observation that the electrical conductivity of the solution changes with change in state of oxidation, an effective method of plant control over the degree of oxidation of the washing solution has been developed.

That sulphur which is oxidised to sulphur oxy-acids has been found to appear mostly in the form of sulphate. The sulphate radical attaches itself to the methylene blue base and is removed when the base is in the leuco form, by reaction with ammonium hydroxide solution. The ammonium sulphate is removed in comparatively strong solution (15%).

Reaction with hydrogen cyanide: If the gas contains hydrogen cyanide, some 90% of this impurity is removed and fixed as thiocyanic acid, which behaves in the same way as the sulphur oxy-acids and can be removed in a similar manner. Cost of removal is stated to be substantially the cost of an equivalent amount of alkali.

Reaction with organic sulphur compounds: If the gas contains carbon disulphide, this impurity will be removed and fixed as thiocarbanilide which, in turn, will leave the system as crystals mixed with the crystals of sulphur. Recovery of aniline from thiocarbanilide has not proved a simple operation. It is suggested that in most cases it will be preferred to remove the carbon disulphide by oil washing for oil washing.

Reaction with certain hydrocarbons: Steps taken to avoid trouble when gases contain certain unsaturated hydrocarbons (giving rise to pitch-like materials, believed to be mainly di-olefins), are the washing of the gas with gas oil or other suitable solvent.

Oxidation of aniline: Because of doubts about the stability of aniline in the presence of free oxygen, particularly oxygen under pressure, tests have been made in a bomb calorimeter where a small quantity of aniline in the presence of methylene blue and sulphur was exposed to a large excess of oxygen at 25 atm. pressure and at temperatures up to 50°C. No sign of oxidation or change in weight has been observed.

No Complications

In three years of operating experience with this process, Davis *et al.* state no other complicating side reactions have been observed.

At present the gas purification process using methylene blue is visualised in two forms, one working with gas at a pressure of several atmospheres, and the other treating gas at near atmospheric pressure. If the gas is at high pressure, losses of aniline vapour losses can be kept to a low level and removal of pitch-forming hydrocarbons and carbon disulphide by oil require only a small oil-washer. To avoid complications, therefore, the low-pressure system is visualised as comprising two circuits. In the first, alkaline aqueous solution comes in contact with the gas and removes H_2S as the hydrosulphide of the dissolved alkali. Fouled solution is regenerated by stirring with a solution of methylene blue in aniline when the hydrosulphide is completely oxidised and the aqueous solution returns to the gas-scrubber H_2S-free. Experimental work has shown that the gas can be purified to the statutory limit by this regeneration technique. In the double circuit system difficulties of fouling and vapour loss are eliminated by avoiding direct contact of the aniline solution with the gas.

For purification of gas at high pressure the simple single-circuit process is applicable. Three vessels and three operations are involved. In the absorber H_2S is removed from the foul gas and oxidised, the sulphur going into solution.

Pilot plant: This has been operating intermittently under a variety of conditions for about three years. It was designed to purify up to 200 cu. ft. of gas/hr. at a pressure of 300 lb./sq. in. Town gas with H_2S added was used. To determine the effect of CO_2, this gas was added under pressure at the oil-washer outlet. The presence of 30 to 40% CO_2 in the gas was found to make no measurable difference to the absorption rate.

The most successful types of absorber were the plate-type and the ring-packed-type. For design purposes the basic factor to be determined is the number of plates or the height of packed column needed to reduce H_2S concentration in the ratio of 10^{-1}. It was found that three sieve plates were sufficient to give this reduction in H_2S concentration and that 12 plates should suffice for a reduction of 10^{-4} and 18 plates a reduction in the ratio 10^{-6} or an H_2S concentration in purified gas of only 1 part/100 million. A 2 in. dia. column packed with $\frac{1}{2}$ in. Raschig rings to a depth of 6 ft. reduced H_2S concentration in the ratio 10^{-4} at 200 cu. ft./hr. (an absorption coefficient of 0.0038 lb./hr./sq. ft. of surface). Attempts to scale-up on these results have indicated the difficulty of predicting the effective welted surface in such a column, it is reported, when both the size of the column and size of rings are to be changed.

In the crystalliser (2 in. dia. by 4 ft. long) fouled solution passed up at 0.1 ft./sec. A bed of sulphur crystals was maintained in this tube to induce the sulphur coming out of solution to deposit on these crystal surfaces and so avoid fouling the heat transfer surface. (Heat transfer coefficient was only about 25 B.Th.U./sq. ft./°F./hr.) This principle will be followed in the design of the larger unit.

The absorber is operated at 90° to 100°F. and in the crystalliser the solution was cooled by about 10°F.

The slurry of crystalline sulphur is run off periodically and filtered. The filter cake has been found to contain 85% sulphur, the remainder being aniline/methylene blue solution. Aniline is displaced by washing with water and sulphur of 99% purity is obtained. Because of the toxic nature of aniline vapour, a final wash with dilute HCl is given to fix any traces of aniline as the chloride.

It has proved practicable to carry through the re-oxidation of the circulating liquid to the desired extent, using only a small excess of oxygen. In the small pilot plant, as it has been worked, and in the projected semi-scale plant, the amount of oxygen in contact with aniline can be so limited that, if the whole of it were unexpectedly to react simultaneously with the aniline present, it cannot raise the temperature more than a few °C. Although in the pilot plant oxidation was carried out in a ring-packed flooded tower scaling up the design for the semi-scale plant is stated to be not so simple. It is proposed to use a coil of pipe through which oxygen and the solution will pass in concurrent turbulent flow. Immersed in a tank of warm water, it can serve as a heat exchanger for rewarming the solution after crystallisation as well as for carrying out the oxidation reaction.

Developments in Alkaline Tin Plating

FOLLOWING negotiations with the Metal and Thermit Corporation, New York, Albright and Wilson (Mfg.) Ltd., will be the main suppliers of potassium stannate for both immersion plating and electro-tinning in the U.K.

The best known application in immersion plating is in the tinning of aluminium pistons. The use of potassium stannate instead of sodium stannate will, it is claimed, make possible substantial reductions of sludge formation together with much improved analytical control limits. Plating baths can be operated continuously and far less time will be spent by operatives on control and maintenance.

In electroplating, solutions containing potassium stannate will, it is said, have a far greater electrical conductivity than a similar solution containing the same concentration of sodium stannate, giving higher current densities for a given voltage. Alternatively a dilute potassium stannate solution can give the same plating rate as a more concentrated one containing sodium stannate, so that wastage by dragout, and initial costs are reduced considerably.

Albright and Wilson have also been licensed by Metal and Thermit to supply 'high speed' tin anodes. One of the main difficulties associated with alkaline electro-tinning is in maintaining the surface of the tin anode in the correct condition. When operating properly the anode should be coated with a film. If this film is not present it means that the anode is either dissolving too slowly or too fast.

Data sheets on potassium stannate are available from the A. and W. Metal Finishing Department, 1 Knightsbridge Green, London S.W.1. Metals and Methods Ltd., Langley, Slough, have been appointed sole distributors in the U.K. of 'high speed' tin anodes by Albright and Wilson. Purchasers of potassium stannate and 'high speed' tin anodes from Albright and Wilson are conveyed a free licence to operate under B.P.'s 564489, 738018, 596375.

PEOPLE in the news

● MAJOR C. J. P. BALL has retired from the boards of British Resin Products, Distrene, and British Geon, the three companies which form the Distillers Plastics Group. MR. T. F. A. BOARD, a director of the Distillers Company, has been appoined chairman of British Geon and of Distrene. MR. H. H. WOOLVERIDGE, who is chairman of the Distillers Plastics Group, has been elected chairman of British Resin Products and MR. P. A. DELAFIELD, group managing director, is managing director of B.R.P.

● Mervyn Instruments Ltd., Woking, Surrey, have enlarged their marketing organisation by appointing MR. V. M. FARRANT as sales promotion manager; MR. P. M. BARTLETT as divisional sales manager; and MR. J. A. SHELTON and MR. A. E. DESLANDES, as technical sales officers.

● MR. W. R. MILLER, B.A., M.A., who, as announced in 'People in the News,' 15 November, has been appointed general manager of the Boehringer Products Division of Pfizer Ltd., Folkestone, joined Pfizer in July 1952 as assistant to the general manager. He was appointed field area supervisor in charge of the International Operations Group in September 1955, in which capacity he supervised Pfizer business in Scandinavia, Ireland and British African territories. Mr. Miller became area supervisor for the Northern European and African Area in September 1956, and had charge of area headquarters organisation with direct responsibility for several markets within the area.

W. R. Miller

● MR. J. A. CALNAN has been appointed assistant sales manager of Vinyl Products Ltd., Butter Hill, Carshalton.

● Honorary degrees of D.Sc. were conferred at Oxford last week on DR. RONALD HOLROYD, a deputy chairman of Imperial Chemical Industries Ltd. and MR. A. H. WILSON, F.R.S., managing director in charge of research and development, Courtaulds Ltd. The Public Orator spoke of Dr. Holroyd's researches into the extraction of liquid fuel from coal and of the fact that he had devised the I.C.I. transfer scholarship scheme. Mr. Wilson was presented as the author of important works on metallurgy, atomic physics and thermodynamics and as a highly skilled business man who had inspired the Industrial Fund for providing laboratories for independent schools.

● PROFESSOR F. C. HAPPOLD, D.Sc., Ph.D., professor of biochemistry at Leeds University has been invited to accept a research professorship at Florida University for a period of three months from January 1959.

● MR. B. H. COURT, a 23-year old refinery chemist employed by Esso Refinery, Fawley, Hants, last week became the 1,000th student to join one of the standard four-week courses at the Harwell Isotope School. In addition, more than 700 have attended shorter specialised courses. Many branches of science have been represented, but chemistry heads the list with 37%.

● MR. R. W. RUTHERFORD, joint deputy managing director of the Power-Gas Corporation Ltd., has been appointed chairman of Nuclear Chemical Plant Ltd., 22 Carlisle Place, London, S.W.1, the company formed jointly by Power-Gas, Humphreys and Glasgow Ltd. and John Thompson Ltd. for the design and engineering of process and treatment plant for the nuclear industry. MR. C. GRESLE FARTHING, deputy chairman and joint managing director of Humphreys and Glasgow Ltd., and MR. J. H. N. THOMPSON deputy chairman and joint managing director of John Thompson, have been appointed as directors. MR. C. J. CARTER, a director of John Thompson-Kennicott Ltd., MR. C. ROBSON, a director of Power-Gas, and MR. N. H. WILLIAMS, a director of Humphreys and Glasgow, are appointed alternate directors. MR. R. JOWITT (Humphreys and Glasgow), is general manager and MR. E. J. G. GOOD (Power-Gas) is secretary. Members of the staff who are being trained by the U.K. Atomic Energy Authority at the Industrial Group, Risley, are MR. J. S. M. JONES (Humphreys and Glasgow), MR. E. G. SPALDING (John Thompson) and MR. N. E. WILLIAMS (Power-Gas).

● MR. PETER CHRISTOPHER ALLEN, M.A., B.Sc., director of the main board of Imperial Chemical Industries Ltd. in charge of group F (fibres) since early 1955, has been appointed president of Canadian Industries Ltd., Montreal, in succession to MR. H. GREVILLE SMITH. As announced last week, Mr. Smith, immediate past-president, Society of Chemical Industry, is resigning from C.I.L. Mr. Allen, who remains on the I.C.I. board in a non-executive capacity, will join C.I.L. on 1 January. Mr. Allen joined Brunner Mond and Co. now I.C.I.'s Alkali Division, in 1928 as a chemist. He served on the alkali commission to Canada in 1933 and was appointed alternate delegate director of the Alkali Division in 1942. From 1942 to 1948 he was joint managing director of the Plastics Division, becoming division chairman in May 1948. In 1951 he joined the I.C.I. main board in charge of Group E (paints and plastics). Two years later he became director in charge of the Terylene Council.

P. C. Allen

● United Indigo and Chemical Ltd. announce that MR. BURN, MR. ELLAN and chairman, MR. W. S. HEIGWOOD, will resign from the board on 15 December. MR. D. R. JUDD and MR. W. O. CROSSLEY are proposed as new directors. The three retiring directors are willing to serve in executive capacities.

● MR. A. H. N. WELLS has been appointed controller of personnel in the Industrial Group of the Distillers Co. Ltd. in succession to the late MR. H. A. BARNES-LAWRENCE, under whom he served as deputy controller since 1955.

In Parliament

'I.C.I. Strike Possible if Disputes Order is Abolished'

Abolition of the Industrial Disputes Order might lead to strike action in the chemical industry, suggested Captain M. Hewitson (Lab., Kingston-upon-Hull, W.) during a Commons debate last week. I.C.I. were outside the joint industrial councils which provided for a form of arbitration in the event of disagreement. I.C.I. management had to deal with 17 unions. In the event of negotiations breaking down, which was rare, the sides went to arbitration under the present Order. If that were to disappear, the only possibility in such a dispute would be strike action.

Mr. Richard Wood, Parliamentary Secretary, Ministry of Labour, was convinced that joint consultation and collective bargaining were essentially voluntary exercises in collaboration. Until they relied on voluntary machinery in such settlements, they were unlikely to arrive at agreed methods of resolving disputes, acceptable to both sides.

A motion to reverse the Government's decision to abolish the Order was rejected by 312 to 246 votes.

NCL Service Justified

In reply to a question in the House of Commons concerning the National Chemical Laboratory's service of providing standard samples of organic compounds to industry, the Parliamentary Secretary to the Ministry of Works said the service was being continued because it was valuable to industry which needed those materials for the calibration of instruments used in controlling industrial processes. Of the 709 samples sent to 67 laboratories, 200 went to foreign countries, 12 to Australia and the rest to laboratories in this country.

Overseas News

WASTE STEEL PLANT GASES USED AS SOURCE OF N AND H FOR AMMONIA SYNTHESIS

SOURCES of nitrogen and hydrogen for ammonia synthesis at Huettewerke Salzgitter AG., Brunswick, West Germany, are waste coke-oven and blast furnace gases from a steel plant. Details of the operation of the plant (*Chem. Engng.* 1958, *65*, 72) show that the coke-oven gas containing 60 per cent hydrogen, 24 per cent methane and 6 per cent carbon monoxide is fed alternatively to one of two parallel reactors preheated for 11 minutes to 2,640°F by combustion of blast furnace gas.

In a five-minute operating cycle, the gas is cracked in the reactor and reformed with steam to yield a gas containing 77 per cent H_2, 15 per cent CO and 0.7 per cent CH_4. This cracked, reformed gas is mixed with steam and another stream of blast furnace gas composed of 31 per cent CO, 10 per cent CO_2, 1.2 per cent H_2 and nitrogen. By shift conversion of CO and H_2O to CO_2 and H_2, the mixed stream contains at the end 20.5 per cent CO_2, 3.5 per cent CO, 56.7 per cent H_2 and the balance N_2. The carbon dioxide is removed by washing the gas by the Uhde system and the CO is recycled to a shift converter. Synthesis gas then passes to a conventional catalytic ammonia process.

It is reported that one ton of ammonia is produced from 49,000 cubic feet of coke-oven gas and 35,000 cubic feet of blast furnace gas. Gas used for heating the reactors totals 84,000 cubic feet of blast furnace gas. Total plant investment is stated to be about £38 per ton of annual capacity.

Dow Chemical to Build Fluorspar Mill in Mexico

Construction is expected to start early in 1959 on the La Domincia Fluorspar Mill in Mexico, it was announced by The Dow Chemical Co., Michigan, U.S.

The Dow subsidiary—La Domincia, SA De C.V.—will produce initially 100 tons per day of acid-grade concentrate from fluorspar ore mined in Mexico. Engineering already has started, and the tentative completion date for the mill and other facilities has been set for early in 1960. The project includes housing for some 25 Mexican nationals who will be employed in the milling operation.

Italian Co-operates in Indian Rayon Venture

Ten tons of fibre yarn, 10 tons of artificial silk yarn, 35 tons of sulphuric acid and 7½ tons of carbon disulphide will be the daily yield of a plant to be built by a newly-formed Indian company, South India Viscose Ltd. The plant, to be erected at Coimbatore, in Bombay State, will come into production in, or possibly before, 1960. Machinery for the plant and technical aid in its erection are being supplied by the Milan-based firm of Italviscosa Eastern Trading S.p.A., with whom the machinery contract will total Swiss francs 44 million (about £3,670,000) out of the total outlay of an estimated Sw. frs. 80 million (about £6,670,000) needed for the project. The Italian company will hold 25 per cent of 35 million rupees' worth of initial share capital.

The new plant is said to be sure of an assured and steady market since the demand for fibre- and rayon-yarns in South India alone is double the capacity of the new plant; the total number of plants in the whole country now producing artificial silk yarns is only four, and their capacity is 29 million lb. annually against a national demand of approximately 68 million lb.

Further Expansion by Reichhold Chemicals in France

Plans for an additional factory near Bordeaux are announced by Reichhold-Beckalite S.A., a subsidiary of Reichhold Chemicals Inc., U.S. The new plant, which is to produce basic chemicals and synthetic resins, is scheduled for completion by mid 1959.

Italian Mercury Production Increases While Exports Drop

Heavy manufacture tax is blamed by producers for the alarming drop in mercury exports from Italy, while production has risen 6.5 per cent. Only 12.8 per cent of production is being exported this year compared with 64.8 per cent in 1957. The tax was imposed when the industry was flourishing but the current price has dropped considerably since and the Italian exporter can no longer compete in world markets.

Bulk Shipments of Methyl Borate Now Available from Callery

Methyl borate, $B(OCH_3)_3$, and methyl borate—methanol azeotrope, are now being produced in quantities that permit shipments in bulk from Lawrence, Kansas, by Callery Chemical Co., Pittsburgh, U.S. Methyl borate is a colourless liquid which solidfies at −29°C and boils at 68.7°C. Density is 0.9265 g/ml. at 25°C and viscosity is 3.565 millipoises at 25°C. It serves as a catalyst for condensation of ketenes with aldehydes or ketones to form β-lactones. It forms azeotropes with many other liquids and has been used to separate various types of hydrocarbons, particularly close-boiling naphthenes, by azeotropic distillation.

Liquid sulphur trioxide can be stabilised with small amounts of methyl borate, which inhibits formation of solid polymers. Methyl borate, mixed with other volatile materials such as alkyl halides, has been used in the fuel lines to welding torches to produce boric oxide fluxing, thus avoiding separate applications of flux for welding and brazing. Trialkyl boranes or triaryl boranes may be prepared by Grignard reactions.

Ethyl-amyl-ketone from U.S. Shell

Shell Chemical Corporation U.S., are offering ethyl-amyl-ketone as a solvent with high boiling-point for cellulose esters, vinyl polymers and many other synthetic resins. The product has a slow evaporation speed, say Shell, and may be used with other solvents.

Houdry Introduce Spherical Kaolin Catalyst

Kao-spheres, a new spherical Houdry mineral kaolin cracking catalyst, designed to decrease catalyst use and reduce equipment maintenance costs, is now being offered by Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Penn. The catalyst itself provides maximum octane at low cost, high activity, sulphur resistance, high thermal stability and excellent regenerability.

The spherical form is used to sharply reduce catalyst chipping and loss in fines. Less maintenance is needed because the Kao-spheres do not have sharp edges that may cause equipment erosion. The new spherical form is expected to provide refiners, particularly catalytic crackers, with a more economical method of operation while retaining all the advantages of the high-octane, low-cost Houdry mineral kaolin. The catalyst will be particularly effective for Houdriflow, and all other moving bed catalytic cracking units.

Further information on Kao-spheres is available from the Corporation's London representative at 21 Ironmonger Lane, London E.C.2.

Polypropylene Foil for U.S.

The first polypropylene foil has been put on the market by the American company of Ludlow Papers Inc., under the trade name of Proplene. The foil is produced by a newly-developed process for unsupported foils, the Flex-L-Process, from polypropylene manufactured by Hercules Powder.

Soda Ash Factory for Formosa

A new soda ash factory is being built at Suao, on the east coast of Formosa, for the Tung Nan Alkali Corporation, to the designs of a West German engineering firm, and incorporating West German machinery. The factory, it is predicted, will begin production in July next year.

TRADE NOTES

Stanton Guarantee

From 1 December, Stanton Instruments Ltd., 119 Oxford Street, London W.1, are giving a one-year guarantee on all their aperiodic, single pan, semi-micro and micro-balances supplied in the U.K. In addition, customers will receive one free service visit during this period to ensure that instruments are functioning correctly and giving satisfactory service. The scheme is to be backed by the Stanton service organisation which operates from London, Southampton, Bristol, Birmingham, Leeds and Edinburgh.

New Simon-Carves Department

A new department to build plants for complete gasification, gas reforming, ammonia synthesis and the production of nitrogenous fertilisers and certain types of petrochemicals has been set up by Simon-Carves Ltd. The department is under the management of Dr. A. J. Payne, B.Sc., Ph.D., A.M.I.Chem.E., whose sales and projects organisation is in the London offices of Simon-Carves at 28 Dover Street, W.1. Contract work is dealt with at the head offices at Cheadle Heath, Stockport, Ches.

James Gordon Extension

James Gordon and Co. Ltd. have recently added a third building to their premises at Dalston Gardens, Stanmore, Middx. This provides accommodation for the enlarged projects department, and was necessitated by constant expansion of work in hand and the incorporation of the power plant division of Elliott Bros. (London) Ltd. in the Gordon organisation. The building also includes a new store for spares and service requirements.

New Unilever Company

Unilever Ltd. have formed British Extracting Co. (Sales) Ltd. to market a wide range of chemical products for agriculture. The first product, Pep—a combined detergent steriliser in stable free-flowing soluble powder form, was introduced for the dairy last month.

Import Duty Exemption

Under the Import Duties (Exemptions) (No. 22) Order, 1958, the Treasury have exempted *N*-(2-aminoethyl) ethanolamine from import duty for the period ending on 31 December 1958. The Order came into operation on 25 November and has been published as S.I. 1958-1896.

Alkyd-Isocyanate Polyester Resin

C. J. W. Macaulay, chemical consultant, 60-66 Wardour Street, London W1, is now marketing in the U.K. a new high gloss, heat-resistant 'D.D. Lakk' manufactured by Star Maling. Both the clear and pigmented lacquers of 'D.D. Lakk,' the result of new developments in cross-linked cyanates polymers, produce hard surfaces of exceptional high gloss. The product is supplied in two separate components, 'A' and 'B', representing respectively the alkyd-isocyanate and the polyester. Able to withstand temperatures of 180-120°C, D.D. Lakk is said to be particularly suitable as a protective coating for heavy-duty engines and machinery. Resistant to chemicals, solvents, fresh and salt waters, it has very good weathering properties; when applied to metal a zinc chromate primer is recommended; applications on wood do not require any special primer.

'D.D. Lakk' has been approved by Det Norske Veritas as a flame-proof and fire-resistant material for use on all ships under classification F.

Changes of Address

Heather Filters Ltd., manufacturers of air filtration equipment and distributors of Satomair and Humexair humidity control equipment, have moved their offices to 7 Kendall Place, Baker Street, London W.1 (Hunter 1801).

London offices of Metropolitan-Vickers Electrical Co. Ltd. have been moved to 33 Grosvenor Place, S.W.1 (Belgravia 7011).

New and Cheaper Q.V.F. Condenser

Improved techniques have enabled Q.V.F. Ltd., Fenton, Stoke-on-Trent, to introduce a new condenser-type heat exchanger at about one-third the price of its predecessor. The new condenser is more compact and possesses a much higher heat-transfer efficiency. Thinner-walled tubing has been used and, under favourable conditions, the overall heat transfer is increased by 30%.

Oil-resistant Silicone Rubber

A new type of oil-resistant silicone rubber, Silastic LS-53, is now being used by Dunlop for various components in the aircraft industry. Silicone rubber is normally somewhat vulnerable to the swelling action of the synthetic types oils used in high-speed aircraft and Silastic LS-53, a fluorinated silicone elastomer, is said to be notably superior in this respect. It also has excellent low temperature flexibility characteristics and will function in service at temperatures as low as minus 60°C. Although its resistance to heat ageing is less outstanding than that of standards grades of silicone rubber, it can be used in temperatures of up to 200°C.

Additives for Chromium Plating

Zero-mist HT-2, a combination of stable, surface-active additives for all types of chromium-plating baths, including those using catalysts other than sulphate, has just been introduced by the Electro-Chemical Engineering Co., Ltd., of Woking, Surrey. It is supplied in tablet form in two colours, green for initial addition up to 6 lb./1,000 gall. and off-white for maintenance additions. Regardless of the type and operating temperature of the baths, it is claimed that Zero-mist HT-2 produces a thin film of foam on an operating chromium bath that eliminates mist and spray and reduces dragout losses. The surface tension of the solution which is an indication of the concentration of Zero-mist HT-2 and should be 35-40 dynes/cm., may be determined by a simple stalagmometer method.

Platinum Price Cut

U.K. platinum prices have been still further reduced. The two U.K. refiners, Baker Platinum and Johnson Matthey, have reduced their prices by 35s to £19 10s per troy ounce. This is the fifth reduction this year; the previous one, in September, was from £23 5s. The price at the beginning of the year was £28 10s. Reason for this further reduction is the continued competition from Russia, who have been supplying consumers on the Continent with large quantities of metal direct from Russia at £18 to £18 10s an ounce.

Change of Name

Milton Industrial Chemicals (London) Ltd., 42/6 Weymouth Street, London, W.1, have changed their name to Milton Pharmaceuticals Ltd.

Reagents for Zirconium

GRAVIMETRIC determination of zirconium using unsubstituted mandelic acid was introduced in 1947, and Monograph No. 36 (1958) published by Hopkin and Williams Ltd., Chadwell Heath, brings this work up to date with an account of how *p*-bromomandelic acid is now used.

Nuclear-substituted derivatives of mandelic acid were investigated as precipitants for zirconium and *p*-chloro- and *p*-bromomandelic acids were found to be more satisfactory than mandelic acid, one of the chief advantages being the bulkiness of the preciptate which can be washed with water without loss.

p-Bromomandelic acid and its solution remain stable indefinitely. The solution used in the monograph is 0.1 M.

The practical details are:

Heat 50 ml. of the zirconium solution, containing up to 100 mg. of Zr, to about 80°C. Stir in slowly 50 ml. of a 0.1 M solution of *p*-bromomandelic acid previously heated to 80°C and digest the mixture at 80-85°C for 20 minutes. Cool to room temperature, stirring constantly, and filter through a previously ignited and weighed Gooch crucible with an asbestos pad. Wash precipitate with water and dry the crucible plus contents for an hour at 120-130°C. Ignite over a Meker or Bunsen burner, charring slowly at first. Cool and weigh the oxide.

Details of experiments conducted to study interference by other anions is also included in the monograph and the following anions are stated to show no interference:

F', Cl', NO_3', SO_4'', acetate and oxalate. Chromate and vanadate did interfere but after reduction to the metal, neither caused any further interference.

The following cations showed no interference:

Be^{2+}, Mg^{2+}, Ca^{2+}, Ba^{2+}, Zn^{2+}, Al^{3+}, Ti (IV) V (IV), Cr (III), Mn^{2+}, Fe^{2+}, Co^{2+} and Ni^{2+}.

Other methods of zirconium determination using *p*-bromomandelic acid are also described, including one volumetric method.

Commercial News

- **Abrac Problems will 'Soon be Overcome'**
- **Overseas Merger for Glaxo and A. & H.**
- **Revised Agreement Affects Midland Tar**
- **United Indigo Propose 'Close Link-up'**

Allen and Hanburys

Group net profit of Allen and Hanburys for the year ended 30 June was £200,333 (£150,148). Final dividend of 10% (same) is proposed, making 17½% (same, but interim was on smaller capital). The agreement, finalised since the end of the year, to advise on the construction of a pharmaceutical factory in Teheran and to supervise production for 15 years in return for a capital payment and a royalty, will not involve the company in a capital investment.

A. Boake Roberts

Group net profits of A. Boake Roberts and Co. (Holdings), before tax, for the six months to 28 September 1958, totalled £43,500, against £180,000 for the corresponding period of last year.

In maintaining the interim dividend of 5%, the directors state that this interim does not indicate any forecast of the final dividend for the year ending 31 March 1959. There was a final of 10% for 1957-58.

The level of sales was maintained, but expenses increased and there were some reductions in selling prices. Consequently profit margins were reduced, particularly in the export markets. Difficulties had been aggravated by the delay in getting new projects into effective operation particularly the major enterprise at Widnes.

It is expected that most of these difficulties should be overcome within a few months, with corresponding reductions in expenses. These will be too late, it is stated, to improve the rate of profit earning during the remainder of the current year.

Glaxo Laboratories

In some overseas markets, the most profitable co-operation between Allen and Hanburys Ltd., and Glaxo Laboratories Ltd. could only be realised by a complete merger of interests. This was stated by Sir Harry Jephcott, Glaxo chairman, in his annual statement. Because such action might be held to affect the security underlying the A. and H. preference and preferred ordinary shares, proposals will be made to holders of this stock to exchange it for new Glaxo preference shares carrying interest at 6 per cent. Allen and Hanburys will continue as a separate entity in the home market. Other remarks of Sir Harry are reported on page 904.

Group net profit after tax for the year ended 30 June was £2,610,566 (against £1,837,629). Parent company's net profit was £2,032,845 (against£1,655,116). Final dividend of 11¼% is proposed on ordinary, making 17½% (12½%).

Midland Tar

Group net profit of Midland Tar Distillers for the year ended 30 June was £169,907 (£220,896). Dividend is 10% (same), and a special tax-free distribution of 3½% is also proposed. Revised terms of the tar agreement have been negotiated so as to give the producers a larger share of the net revenue of the tar business, effective from 1 July, 1957. This revision, the board states, accounts in the main for the reduction in profit in the accounts for 1957-58.

Steetley Co. Ltd.

The directors of the Steetley Co. Ltd. announce that to bring the issued capital more into line with the funds now employed in the business it has been decided to capitalise £1,417,187 of the reserves by the issue to ordinary shareholders of one new ordinary share for every two shares held at 17 November. These proposals do not necessarily imply that there will be an increased amount paid out in dividends.

United Indigo and Chemical

Following the announcement by United Indigo and Chemical Ltd. that an ordinary dividend would not be paid owing to a group loss of £5,639 (£2,526 net profit) on the year to 30 June last (CHEMICAL AGE, 15 November, p. 814), it is reported that there is a deficiency of £3,908 (surplus £4,993). Current assets are £139,029 (£148,928) and liabilities £16,079 (£17,066).

Turnover is reported as barely maintaining the 1957 level owing to a severe reduction in the Boston, U.S., branch which is to be closed. Trade with home branches has been 'intensely competitive,' and overall turnover has not expanded.

Three courses are open to the company: to liquidate; to distribute a portion of surplus cash resources and carry on with internal reorganisation; to go into new lines. Mr. Dohm, appointed to the board during the year, has proposed a close link-up and this has met with the approval of the major shareholders. (See also p. 910.)

Fertilizers and Chemicals

Nearly every division of Fertilizers and Chemicals Ltd., of Israel, has shown growth during the past year. Production rose by an average of 60% above designed capacity; sales rose by nearly 50% over 1956-57 and turnover was up from I£13 million to more than I£20 million.

Exports have accounted for 12% of the annual sales. In 1957-58, liquid nitrogenous fertilisers, of enriched superphosphate (22-24% P_2O_5) and of triple superphosphate (42-46% (P_2O_5) were successfully introduced.

The nitric acid plant had been completed as planned and was now being commissioned. Other investments were being carried out to meet increased local demand for nitrogeneous fertilisers. Equipment had been ordered for the production of granulated fertilisers and auxiliary installations.

Net profit was I£925,520.

LONDON GAZETTE

Winding-up Petition

Petitions for the winding up of DYNE CHEMICAL WORKS LTD. and W. W. KNOWLES (LONDON) LTD. were presented on 12 November by the Commissioners of Inland Revenue and will be heard at the Royal Courts of Justice, Strand, London, on 1 December.

Market Reports

New Demand Maintained

LONDON Steady trading conditions have been reported for most sections of the industrial chemicals market with new home demand maintained at about the recent level, and good quantities being called for against contracts. Overseas demand for chemicals is keeping up fairly well and a good volume of inquiry is in circulation.

Dichromate, hyposulphite and chlorate of soda are attracting fair attention, and most of the other routine soda products are in steady request at firm prices. There has been no change in the position of the potash chemicals, and sulphate of copper continues to receive a steady inquiry.

Among the coal tar products there has been a steady home demand for creosote oil, and both cresylic acid and refined tar have been in steady request.

GLASGOW After a rather quiet opening, business on the Scottish heavy chemical market showed progression, and by the end of the week a much more favourable position prevailed, although in some sections, the effect of trade recession is being felt.

On the broad side, however, demands were well maintained, particularly in regard to caustics, formaldehyde and acids. Prices generally remain firm.

MANCHESTER Trading conditions on the Manchester heavy chemical market have continued on recent lines. There is room for improvement in the demand for the wide range of bleaching, dyeing and finishing chemicals, but from most other industrial users there is a fair flow of delivery specifications under contracts. Exports are generally well maintained.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 31 December

Lignin-reinforced rubber. United States Rubber Co. **806 712**

Centrifugal atomiser for liquids. Amberg, W. E. **806 848**

Thixotropic aqueous coating compositions. Du Pont De Nemours & Co., E. I. **806 556**

Forced flow, once through vapour generators. Sulzer Freres S.A. **806 561**

Basic steroid derivatives and the manufacture thereof. Hoffman-La Roche & Co., AG, F. **806 581**

Production of esters. Olin Mathieson Chemical Corp. **860 769**

Refrigerant evaporator. Teves, H., Teves, E. A., and Tausend, M. [trading as Teves Maschinen- Und Armaturenfabrik Komm-Ges., A.] **806 860**

Organopoly-siloxane compositions. General Electric Co. **806 563**

Diaminoquinazolines and method of preparing. Wellcome Foundation Ltd. **806 772**

Bleaching compositions. Olin Mathieson Chemical Corp. **806 564**

Organo-silicon polymers. Midland Silicones Ltd. **806 582**

Pharmaceuticals. Merck, AG, E. **806 714**

Methods of producing zinc selenide. Philips Electrical Industries Ltd. **806 566**

Preparation of aldrin. Bataafsche Petroleum Maatachappij N.V., De **806 567**

Cooling devices for evacuated containers. Zeiss-Stiftung, C. [trading as Jenaer Glaswerk Schott & Gen.]. **806 865**

Plastic paraffin wax and process for producing same. Bataafsche Petroleum Maatschappij N.V., De. **806 716**

Process for the deposition of titanium carbide coatings. Metallgesellschaft AG. **806 717**

Preparation of aromatic carboxylic acids containing at least two carboxyl groups and the salts and other derivatives of said acids. Henkel & Cie GmbH. **806 569**

Pyridine derivatives and a process for the manufacture thereof. Hoffman-La Roche & Co., AG, F. **806 584**

Temperature control in the fixed bed catalytic chlorination of hydrocarbons. Dow Chemical Co. **806 570**

Device for distributing finely divided materials. Ganley, B. F., and Ganley, M. R. **806 775**

Synthesis of glutamic acid and intermediates therefor. Du Pont De Nemours & Co., E. I. **806 798**

Desulphurisation and desiliconisaton of pig iron. Soc. D'Electro-Chimie, D'Electro-Metallurgie Et Des Acieries Electriques D. Ugine. **806 776**

Phthalides. Dow Chemical Co. **806 585**

Ointments and creams. Soc. Parisienne D'Expansion Chimique S.P.E.C.I.A. **806 719**

Hexahydroterephthalic acid derivatives. Du Pont De Nemours & Co., E. I. **806 778**

Production of chlorstyrenes. Badische Anilin- & Soda-Fabrik AG. **806 720**

Manufacture of oestrone salt concentrates. Schering AG. **806 779**

Syrup-separating device for sugar centrifuges. Maschinenfabrik Buckau R. Wolf, AG. **806 587**

Resolution of DL-lysine with D-camphoric acid. Dow Chemical Co. **806 588**

Powder dispensing apparatus. British Oxygen Co., Ltd. **806 868**

Preparing esters of unsaturated carboxylic acids. Du Pont De Nemours & Co., E. I. **806 800**

Open to public inspection 7 January 1959

Heat-treatment of uranium. Imperial Chemical Industries, Ltd., Grogan, J. D., Wood, W. A., Colbeck, E. W., and Alexander, W. O. **806 971**

Separation of uranium compounds from suspension. Cruetz, E. C., and Wigner, E.P. **807 151**

Fluid-flow meters. National Research Development Corp. **807 152**

Fluid-flow governors. Jeavons & Co., Ltd., E. E. [Cognate application 17 784.] **806 909**

Valves for controlling the discharge of gas stored in the liquid state. Pyrene Co., Ltd. **807 088**

Manufacture of shortening. Unilever, Ltd. **807 067**

Cation-exchange resins suitable for medicinal use. Baumen, F. W. R. von Den [trading as Roter]. **806 871**

Manufacture of readily dispersible dry dyestuff preparations. Farbwerke Hoechst AG. **807 089**

Method of forming a bonded glass fibre structure. Owens-Corning Fiberglas Corp. **807 014**

Method of producing porous materials suitable for building insulation and other purposes. Wikne, S. **807 015**

Penetration structures for pressure vessels. Chicago Bridge & Iron Co. **807 158**

Laminates of lignin-cellulose comprising a carrier and a synthetic resin cover. Kuennemeyer, F., Kuennemeyer, jun., F., and Kuennemeyer, jun., O. **807 090**

Production of aromatic polycarboxylic acids. Mid-Century Corp. **807 091**

Manufacture of basic ketones. Farbewerke Hoechst, AG. **806 914**

Vinyl monomer and polymerisation products thereof. American Cyanamid Co. **807 016**

Powder metallurgy products. Sintercast Corp. of America. **807 093**

Manufacture of shaped objects from polyamides or polyurethanes by extrusion. Onderzoeking-instituut Research N.V. **807 214**

Recovery of uranium by a resin-in-pulp process. U.K. Atomic Energy Authority. **807 094**

Complex metal salts of oxidised petroleum oils. Socony Mobil Oil Co., Inc. **806 915**

Water cooling towers. Film Cooling Towers (1925), Ltd., and Howe, E. A. A. **806 884**

Bath for the electrolytic deposition of silver or gold or alloys of these metals in highly lustrous form. Deutsche Gold-und Silberscheideanstalt, Vorm. Roessler. **807 095**

Method and apparatus for drying materials difficult to handle. Messager, B. P. **807 083**

Method of preparing quick-cooking and non-glutinous cereals. Koninklijke Pellerij Mercurius Vorheem Geb, Laan, N.V. **807 084**

Process for preparing starch products and the resulting product. Corn Products Refining Co. **807 070**

Methods and apparatus for detecting and/or measuring the condensation of oxygen in aqueous liquids such as boiler feed water. Engelhard Industries, Ltd. **806 918**

Gas compressing plant. Power Jets (Research & Development), Ltd. [Addition to 774 391.] **807 071**

Pipe connections to tanks containing gas under pressure. Soc. Financiere et Industrielle Pour le Fabrication de l'Acide Carbonique pur et Autres Produits Alimentaires, par Abreviation: l'Acide Carbonique pur. **807 165**

Distillation columns. U.K. Atomic Energy Authority. **806 975**

Spinning compositions, and textile fibres produced therefrom, having improved dyeing properties obtained from halogen-containing vinyl polymers, and process for their production. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. **807 086**

Dichlorophenol-modified phenol-aldehyde resins. Olin Mathieson Chemical Corp. **807 020**

Polymer compositions and materials made therefrom. Kodak, Ltd. **806 875**

Combined air filters and silencers. Knecht, A. **806 925**

Moulding compositions. Allied Chemical Corp. **806 926**

Production of pharmaceutical preparations. Imperial Chemical Industries, Ltd. **806 949 & 806 950**

Preparation of C-alkyl isocyclic amines containing polyglycol residues. Henkel & Cie G.m.b.H. **807 099**

DIARY DATES

TUESDAY, 2 DECEMBER

I.Chem.E.—Manchester, Chem. Eng. Buildi Jackson Street, 6-30 p.m. 'Wetted area in packe towers', W. S. Norman and B. Solomon.

WEDNESDAY, 3 DECEMBER

S.C.I.—London: 14 Belgrave Square, S.W.1, 6-30 p.m 'Characterisation of short chain branches in th hydrocarbon polymers', by D. A. Boyle, W Simpson and Dr. J. D. Waldron.

THURSDAY, 4 DECEMBER

Royal Soc.—London: Burlington House, 10-3 a.m. All day discussion on 'The effect of enviro ment upon molecular energy levels', to be opene by Dr. H. W. Thompson.

S.A.C. with R.I.C.—Lancaster: Storey Institute 7-30 p.m. 'Some recent advances in polarograph and other electrical methods', by G. F. Reynold

S.C.I. with Inst. Metals—Bristol: University Woodland Road, 6 p.m. 'Titanium and its alloy as materials of construction for chemical plant' by Dr. K. W. J. Bowen.

S.C.I.—Nottingham: Gas Showrooms, 7-30 p.m 'Contracting for complete chemical plant', b Dr. M. Guter.

FRIDAY, 5 DECEMBER

S.C.I.—London: 14 Belgrave Square, S.W.1 5-45 p.m. 'Gibberellic acid on plant growth an development', by Dr. P. W. Brian and 'Th chemistry of giberellic acid', by Dr. B. E. Cross.

Fisons hold 5-Centre Conference on T.V.

WHAT is believed to be the first confer ence of its kind was held this week by Fisons Pest Control at Chesterford Park Research Station, near Saffron Walden Essex. The conference used the medium of closed-circuit television and was relayed to London, Bristol, Manchester Edinburgh and Lincoln.

Welcoming the audience to the ex periment, Sir Clavering Fison, chair man of Fisons, said they already had in mind for next year a link up covering Europe and possibly even colour T.V. The idea of talking to these different centres simultaneously meant that many more people could take part. The audience included farmers and merchants.

After a reminder of the introduction earlier this year of 18-15, he spoke of the work of Dr. R. K. Pfieffer and his colleagues and how they had been gaining experience during this summer of the possibilities of 18.15.

Changes in C.A. List of British Chemical Prices

THE following are price changes recorded in the past month. The full CHEMICAL AGE table of British Chemical Prices was published in our issue of 26 July p. 164. Other changes were noted in C.A. as follows: 30 August, 27 Septem ber, 25 October.

Acetic Anhydride. Ton lots, d/d, £128

Copper Carbonate. Per lb., 2s 3d.

Copper Sulphate. F.o.b., less 2%, in 2 cwt. bags, £78.

Zinc Oxide. Max. for 2-ton lots, d/d white seal £100 10s, green seal £98 10s red seal £95 10s.

The price of 'salicylic acid' should read: 'Tech, d/d, per lb., 2s 4d, 1-ton lots.'